Engineering Library

Printed on Thin Paper for Foreign Circulation.

OCT 9 1923

The Engineer.

Established 1856.

Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 33, NORFOLK ST., STRAND, LONDON, W.C. 2.

VOL. CXXXVI.—No. 3535] LONDON: FRIDAY EVENING, SEPTEMBER 28, 1923 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.

Science and Industry in America—No. III.

The Design of Pontoons.

Technical Education in China.

Timothy Hackworth and the Locomotive.

Shipping, Engineering and Machinery Exhibition at Olympia—No. V.

The British Association at Liverpool—No. II.

Besson Commercial Seaplane.

PUBLIC NOTICES

The Director-General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, REQUIRES :—

1. NAVY BLUE SERGE.
2. OXFORD GREY CLOTH.
3. GLASS TUBES WITH CORKS, in MILLBOARD BOXES.
4. BUFFERS, JONES' PATENT.
5. DOG SPIKES.
6. SCREW SPIKES.

Tenders due on the 16th October, 1923, for Nos. 1 to 4, and on the 9th October, 1923, for Nos. 5 and 6. Tender forms obtainable from above. 3615

Applications are Invited in respect of a VACANCY for a SENIOR SCIENTIFIC ASSISTANT in the EXPERIMENTAL DEPARTMENT of H.M. SIGNAL SCHOOL, PORTSMOUTH.

2. The duties are to take charge of the section dealing with investigation and development of receiving apparatus for wireless telegraphy as used for naval purposes.

3. Applicants should possess an Honours Degree in Physics or Electrical Engineering, and it is essential that they should have had considerable experience of independent research in wireless telegraphy or allied electrical subjects.

4. The salary scale is £500, rising by annual increments of £25 to £600 per annum, plus Civil Service bonus. The present total value of £500 is £684 approximately. The appointment will carry superannuation benefits and will be, in the first instance, for three years.

5. Applications, giving full particulars of age, nationality, scientific experience, publications, war experience, &c., should be addressed to the SECRETARY of the ADMIRALTY (C.E.), Whitehall, London, S.W. 1, not later than the 10th October next. 3637

Assistant Civil Engineers REQUIRED in Civil Engineer-in-Chief's Department, Admiralty, at H.M. Naval Establishments at home and abroad. Candidates must be corporate members of the Institution of Civil Engineers and not more than 30 years of age. Successful candidates will be on probation for two years, on satisfactory completion of which they will be appointed to the permanent staff, and will then be eligible for promotion to higher grades on the usual conditions.

Commencing salary £300 per annum; the current Civil Service bonus, at present about £106, will be paid in addition.

TEMPORARY ENGINEERING ASSISTANTS REQUIRED in London Office of Civil Engineer-in-Chief's Department, Admiralty, and at Outports. Candidates should have had a good general civil engineering experience and be capable draughtsmen, of between 24 and 28 years of age; if selected, they will be eligible, after one year's service—provided they are satisfactory and otherwise qualified—for the appointment of Assistant Civil Engineer on conditions mentioned above for that grade.

Commencing salary £150 per annum; the current Civil Service bonus, at present about £88, will be paid in addition.

In considering the limits of age some allowance will be made for war service.

No candidate will be accepted for an appointment who fails to pass a strict medical examination as to his physical fitness.

Forms of application can be obtained from Civil Engineer-in-Chief's Department, Admiralty, London, S.W. 1. Applications must be made on the recognised form and should reach the CIVIL ENGINEER-IN-CHIEF, Admiralty, not later than 6th October. 3548

The University of Sheffield.

SESSION 1923-24.

Vice-Chancellor:
Sir HENRY HADOW, C.B.E., D. Mus., LL.D.

DEPARTMENTS OF MECHANICAL, ELECTRICAL, AND CIVIL ENGINEERING, METALLURGY, MINING, FUEL TECHNOLOGY, AND GLASS TECHNOLOGY.

The Courses in the DEPARTMENT of ENGINEERING extend over three or four years and prepare students to become Mechanical, Electrical, Civil or Mining Engineers, or specialists in Fuel Technology or Glass Technology.

The Courses in the DEPARTMENT of METALLURGY cover a period of three or four years and prepare students for positions of responsibility either (1) in Iron and Steel Manufacture, or 2) in the Non-ferrous Metallurgical Industries.

The LECTURE COURSES in all the Departments are supplemented by Practical Training in Laboratories and Workshops, which are fully equipped for the purpose of advanced scientific teaching, investigation and research.

Part-time Courses are arranged for students who desire to take special portions of any of the regular courses.

In Mining Engineering and in certain of the Courses in Mechanical and Electrical Engineering and in Glass Technology, arrangements are made to enable students, who come to the University from works or collieries, to take six months' courses of study at the University and six months' practice at the works or colliery each year for a period of four years.

The LECTURE COURSES commence OCTOBER 3rd, 1923.

The TECHNICAL LABORATORY COURSES commence SEPTEMBER 25th, 1923.

For further details of the Courses and for particulars of the Degrees, Associateships, Diplomas, and Certificates awarded on their successful completion, application should be made to

W. M. GIBBONS,
Registrar.
3390

The Yarrow Scholarships.

The Council of the Institution of Civil Engineers are prepared to consider APPLICATIONS for NOMINATIONS to the above SCHOLARSHIPS. These should be submitted before the 1st October, 1923, to the SECRETARY of the INSTITUTION, at Great George-street, Westminster, S.W. 1, from whom the detailed regulations may be had on application.

The Yarrow Scholars must be British subjects, who, desiring to become engineers, lack sufficient means to enable them to pursue their practical or scientific training.

The Scholarships are of a value varying from £50-£100 per annum. 3185

PUBLIC NOTICES

County of London.
BLACKWALL AND ROTHERHITHE TUNNELS.—SCAVENGING, &c.

The London County Council invites TENDERS for the REMOVAL and DISPOSAL of SLOP and REFUSE from, and the SUPPLY and DELIVERY of BOGGIN and SAND to, BLACKWALL and ROTHERHITHE TUNNELS, during the twelve months commencing 20th December, 1923.

Persons desiring to submit Tenders may procure a form of Tender from the Chief Engineer of the Council, at the Old County Hall, Spring-gardens, S.W. 1. No Tender received at the County Hall after 4 p.m. on Monday, 15th October, 1923, will be considered.

JAMES BIRD,
Clerk of the London County Council.
3540

TENDERS INVITED.

County of London Electric SUPPLY CO., LTD.
BARKING POWER STATION.

The County of London Electric Supply Co., Ltd., are prepared to receive TENDERS for the CONSTRUCTION of a TUNNEL under the RIVER THAMES at Barking.

The specification, schedule, form of Tender, and other particulars can be obtained from Sir Alexander Gibb and Partners, Queen Anne's Lodge, London, S.W. 1. A deposit of £15 15s. will be charged for the documents and this will be returned on receipt of a bona fide Tender by the date below mentioned.

Sealed Tenders, endorsed "Tender for Barking Tunnel," must be delivered to the Chairman and Managing Director of the County of London Electric Supply Co., Ltd., at Moorgate-court, Moorgate-place, E.C. 2, not later than Noon on 22nd October, 1923.

The Company do not bind themselves to accept the lowest or any Tender.

F. C. McQUOWN,
Manager and Secretary.
County of London Electric Supply Co., Ltd.
Moorgate-court, Moorgate-place, E.C. 2. 3628

Nottingham Corporation.
NORTH WILFORD POWER STATION.

The Nottingham Corporation invite TENDERS for the MANUFACTURE, DELIVERY, and ERECTION of the undermentioned ENGINEERING WORK in connection with the above Power Station, viz.:—

SECTION "G"—ONE 25-TON OVERHEAD TRAVELLING ELECTRIC CRANE.

Specifications and forms of Tender may be obtained from Messrs. Preece, Cardew and Rider, 8, Queen Anne's-gate, Westminster, S.W. 1, on payment of a deposit of £2, which will be refunded on receipt of a bona fide Tender within the prescribed time.

Sealed Tenders, endorsed "Electricity Department Tender for Workshop Crane," must be delivered to me at my office before 10 a.m. on Friday, 19th October, 1923.

The lowest or any Tender will not necessarily be accepted.

By Order,
W. J. BOARD,
Town Clerk.

Guildhall, Nottingham,
20th September, 1923. 3629

The Madras and Southern MAHRATTA RAILWAY COMPANY, LTD.

The Directors are prepared to receive TENDERS for: GIRDER BRIDGES, comprising DECK SPANS of from 6ft. to 67ft.; total approximate tonnage equals 1000 tons,

in accordance with the specification which may be seen at the offices of the Company. The charge for the specification is One Guinea, which will not be returned.

Tenders must be sent in, addressed to the SECRETARY, not later than 2 p.m. on Tuesday, 16th October, 1923, and marked "Tender for Girder Bridges."

The Directors reserve the right of not being bound to accept the lowest or any Tender.

Company' Offices,
25, Buckingham Palace-road,
Westminster, S.W. 1.
19th September, 1923. 3617

PUBLIC NOTICES

The Great Indian Peninsula RAILWAY COMPANY, 48, Copthall-avenue, London, E.C. 2, invite TENDERS for :—

	Fee for Specification.
1. PRESSED STEEL SLEEPERS	£1
2. WROUGHT IRON TIE BARS	10s.

Tenders due by 11 a.m. on 9th October, 1923. Tender forms obtainable at above address. 3658

The South Indian Railway ComPANY, Limited, are prepared to receive TENDERS for the SUPPLY of :—

1. COPPER RODS.
2. MISCELLANEOUS ARTICLES.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Copper Rods," or as the case may be, must be left with the undersigned not later than Twelve Noon on Friday, the 12th October, 1923.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 5s. for each copy of Specification No. 1, and of 2s. 6d. for each copy of Specification No. 2.

Copies of the drawings may be obtained at the offices of Messrs. Robert White and Partners, Consulting Engineers to the Company, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.
91, Petty France, S.W. 1,
21st September, 1923. 3618

The South Indian Railway ComPANY, Limited, are prepared to receive TENDERS for the SUPPLY of :—

SPRING STEEL.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Spring Steel," must be left with the undersigned not later than Twelve Noon on Friday, the 12th October, 1923.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 5s. for each copy of the specification.

Copies of the drawings may be obtained at the offices of Messrs. Robert White and Partners, Consulting Engineers to the Company, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.
91, Petty France,
Westminster, S.W. 1,
26th September, 1923. 3659

Borough of Dover.
TEMPORARY CIVIL ENGINEERING ASSISTANT.

APPLICATIONS are INVITED for the above TEMPORARY POST. Salary £250 per annum inclusive. Practical experience in road and bridge work, sewerage and similar work is essential. Candidates must be good draughtsmen, surveyors, and quick and reliable workers.

Applications, giving particulars of experience and qualifications, together with copies of two recent testimonials, endorsed on the outside of the envelope "Civil Engineering Assistant," are to be sent to the undersigned not later than Friday, the 5th October, 1923,

WM. BOULTON SMITH,
M.Sc. (Eng.), A.M.I.C.E., F.S.I.,
Borough Engineer.
Borough Engineer's Office, Dover,
24th September, 1923. 3648

PUBLIC NOTICES

An Instrument Maker is ReQUIRED in the WORKSHOP of the Physical Department of the Ministry of Public Works, Cairo.

The principal work is the repair and upkeep of X-ray installations and other electrical apparatus.

The selected candidate will be required to have good general experience of mechanical work, with special knowledge of electrical instruments.

The appointment will be for two years only. The salary will be £E360 per annum plus an expatriation allowance of £E90 per annum.

£E30 will be paid in lieu of passage money in each direction.

Applications, accompanied by testimonials, must be sent to the INSPECTING ENGINEER, Egyptian and Sudan Governments, Queen Anne's Chambers, Westminster, London, S.W. 1, before October 7th, 1923.

Envelopes marked "Instrument Maker." 3631

Birmingham Union.
ENGINEER-IN-CHARGE REQUIRED at the Erdington House, Birmingham. Must have thorough knowledge of engineering in the following branches :—Heating and Hot Water, Circulating System and Steam Laundry Machinery, and be able to execute general running repairs. Must also have a thorough knowledge of electricity in all its branches.

Commencing wages 75s. to 85s. per week, according to experience.

Apply at once to the MASTER, Erdington House, Birmingham. 3657

Metropolitan Borough of ISLINGTON.

WANTED, a HANDYMAN STOKER, in good health, under 40 years of age. Three disinfecting chambers. Wages £2 6s. 3d. per week plus bonus (present rate 11s. 11d.).

Applications, in handwriting of the candidate, and accompanied by copies of three recent testimonials, must be received by the undersigned before Noon on Wednesday, 3rd October, 1923.

By Order,
C. G. E. FLETCHER,
Town Clerk.

Municipal Offices,
Tyndale-place, Upper-street, N. 1,
27th September, 1923. 3661

The British Cast Iron Research ASSOCIATION.
APPOINTMENT OF DIRECTOR OF RESEARCH.

The Council invite APPLICATIONS for the POST of DIRECTOR of RESEARCH of the Association at a commencing salary not exceeding £900 per annum, according to scientific attainments.

The duties of the Director will be to attend to the scientific and metallurgical engineering research work of the Association.

Forms of application can be obtained from the undersigned, which are to be returned on or before October 20th, 1923.

THOS. VICKERS,
Secretary.

Central House,
75, New-street, Birmingham,
September 21st, 1923. 3632

SITUATIONS OPEN

WANTED, ENGINEER SALESMAN, with Large experience Light Railway and Rolling Stock. State age, experience, education, languages, &c.—Address, 3623, The Engineer Office. 3623 A

WANTED for Purchasing Dept., Chemical Works, experienced ASSISTANT, familiar with Purchasing Engineering Equipment, Fittings, &c.—Address, stating age, experience, references, salary expected, 3602, The Engineer Office. 3602 A

WANTED, HEAD EXPERT DESIGNER for Woodworking Machinery by First-class Makers. Generous terms to suitable applicant.—Apply, stating age, qualifications, references, and salary required, to Box 292, Willing's, 30, King-street, Covent Garden, W.C. 2. 3652 A

A RATE FIXER REQUIRED by Well-known Firm of Manchester Engineers. Applicants must be able to estimate from drawings and be well up in feed and speed calculations. State age, experience, and salary required.—Address, 3647, The Engineer Office. 3647 A

ASSISTANT CIVIL ENGINEER REQUIRED IMMEDIATELY for Sudan, aged 23 to 27, unmarried; must have first-rate technical qualifications and have had practical experience of levelling, making contour plans, designing works, &c. Irrigation experience desirable. Commencing salary £400 to £500 per annum, according to capacity.—Write full particulars and copies testimonials to K. C., c/o J. W. Vickers and Co., Ltd., 5, Nicholas-lane, E.C. 4. 3638 A

ASSISTANT REQUIRED in Buying Department of Electrical and Mechanical Engineering Firm, with knowledge of Materials and Sources of Supply; used to correspondence. State age, qualifications, and salary required.—Address, 3613, The Engineer Office. 3613 A

SITUATIONS OPEN, Pages 1 and 2
SITUATIONS WANTED, Page 2.
PARTNERSHIPS, Page 2.
PATENTS, Page 2.
MACHINERY, &c., WANTED, Page 3.
FOR SALE, Pages 3 and 4.
AUCTIONS, Page 98.
PREMISES TO LET OR WANTED Page 3.
WORK WANTED, Page 4.
AGENCIES, Page 2.
MISCELLANEOUS, Page 2.

For Advertisement Rates see Page 343, Col. 1.

NUMERICAL INDEX TO ADVERTISEMENTS, Page 95.

SITUATIONS OPEN (continued)

CAPABLE BOILER ENGINEER REQUIRED, to Take Charge of Tubular Boilers and Mechanical Stokers. Must be able to take CO2 readings and furnish detailed reports on plant.—Address, 3573, The Engineer Office. 3573 A

GENERAL MANAGER WANTED by an Important Engineering Company in the North of England. Salary £2000 p.a.—Applications, which will be received as strictly confidential and which must give full particulars of experience and qualifications, are to be made to Box 98, Wheeler's Advertising Agency, Manchester. P8077 A

MAINTENANCE ENGINEER REQUIRED for Large Brick and Pipe-making Plant in India. Unmarried. Age 26 to 30. Good mechanical training essential. Commencing salary Rupees 500 per month, with free unfurnished quarters.—Write, stating experience, to "Z.F. 728," c/o Deacon's, Leadenhall-street, London, E.C. 3. 3663 A

QUALIFIED ENGINEER REQUIRED on Contract by British Firm for large works in India. Knowledge of Vertical and Horizontal Gas and Crude Oil Engines, General Erection, Estimating and Drawing required. Outfit allowance, first-class passage and progressive salary. Engineering degree preferred, but not essential. Write, Box 403, c/o Judd's, 81, Gresham-street, E.C. 2. 3651 A

REQUIRED, YOUNG ENGINEER, Age About 23 or 24, at Depot abroad; good technical knowledge of engineering, combined with workshop experience, for period three years.—Write, stating age, experience, and salary required, enclosing references, to Z. R. 611, c/o Deacon's, Leadenhall-street, London. 3522 A

SALESMAN REQUIRED for London District; Must be capable of selling Boiler Furnaces; small salary and commission paid.—Address, 3619, The Engineer Office. 3619 A

VACANCY Occurs for PRODUCTION MANAGER in Midlands works (200 hands) producing small metal wares from bar, sheet and castings in brass and iron. Candidates must have sound knowledge of piecework prices and economical lay-outs, also proved organisation ability. Those having no technical knowledge, not educated to systematic organisation or not held at least assistant position, should not apply. To ensure consideration applicants must state exactly all positions held, if free or when free, age, remuneration expected.—Address, P8074, The Engineer Office. P8074 A

WANTED, Experienced DRAUGHTSMAN for Pipe Arrangements and Details, capable of taking own measurements on site. Applications by letter only will be considered. Fullest particulars of experience, age, and salary.—AITON and CO., Ltd., Derby. 3644 A

WANTED, TWO SENIOR DRAUGHTSMEN, with first-class experience in the design of Aero-Engines and high-class Motor Cars.—Address, giving full particulars of experience and salary required, 3620, The Engineer Office. 3620 A

CHIEF DRAUGHTSMAN.—A Large Firm of Petroleum and Gas Plant Manufacturers REQUIRE the SERVICES of a CHIEF DRAUGHTSMAN with sound and varied experience in the design and lay-out of modern Large-scale Plant. Good salary paid to suitable man. permanency.—Write, giving age and details of experience, Box 456, Sell's Advertising Offices, Fleet-street, E.C. 4. 3635 A

DRAUGHTSMAN, SENIOR, Constructional, Capable of designing and taking charge of job to completion, REQUIRED IMMEDIATELY. — Write, SANDERS and FORSTER, Hertford-road, Barking. P8072 A

DRAUGHTSMAN WANTED by Firm in N.W. London, with absolutely first-class mechanical knowledge. Some electrical experience would be of assistance. Good salary for the right man.—Address, stating age, salary, and experience, 3522, The Engineer Office. 3522 A

YOUTH, Just Leaving School, REQUIRED for Engineer's Drawing-office, to Operate Photo Printing Machine and make himself generally useful.—Apply by letter, giving references and stating salary required, P8095, The Engineer Office. P8095 A

ADVERTISING DEPT. CLERK (Young Man Preferred, lady considered) WANTED IMMEDIATELY by well-known Engineering Firm, Westminster. Must be expert shorthand-typist, used to keeping blocks, photographs, advertisements, records, stock of catalogues, checking insertions and invoices, filing, &c. Permanency for energetic, accurate, and willing worker. State details, age, experience, salary.—Address, 3637, The Engineer Office. 3637 A

ESTIMATOR, Accustomed to Tendering for Electric Motors, Switchgear, &c. Applications, stating age, training, experience, and salary required.—Address, 3612, The Engineer Office. 3612 A

SITUATIONS WANTED

ADVERTISER (42), Life Experience Works Organisation, cost and production systems, stores control, general engineering, and mass production experience, DESIRES POST as Works Accountant or Production Man or similar post.—Address, P8091, The Engineer Office. P8091 B

A.M.I.C.E. (32), Apprenticed Crewe Works, with A. D.O., locomotive steam sheds, internal combustion, maintenance of plant, estimates and specifications, and commercial experience, wide technical knowledge, has had control of large staffs, not a specialist, DESIRES POST.—Address, P8054, The Engineer Office. P8054 B

CHIEF CHEMIST DESIRES POSITION: 24 Years in steel and motor works, sound experience ferrous and non-ferrous analysis, heat treatment and metallography.—Address, P8070, The Engineer Office. P8070 B

CIVIL ENGINEER, Age 22, University Diploma (3 years), Stud. Inst. C.E., DESIRES EMPLOYMENT at home or abroad.—Reply to G. E. STEAD, 19, Chestnut-avenue, Hyde Park, Leeds. P8068 B

COMPETENT MACHINERY DESIGNER (25 Years' extensive experience) will Design throughout any Special Machine at client's works or own office on reasonable terms.—Address, P8093, The Engineer Office. P8093 B

ENGINEER (24), University Dip., Civil and Struct., 4 years' shops and D.O. exp., SEEKS APPOINTMENT, home or abroad.—Address, P8069, The Engineer Office. P8069 B

ENGINEER (34) DESIRES POST, Assistant Works Engineer; sound training and good experience in all branches of engineering, D.O., construction, maintenance, gas producers, furnaces, glass, chem. works; used to control.—Address, P8088, The Engineer Office. P8088 B

ENGINEER (M.I. Mar. E.) REQUIRES PART-TIME EMPLOYMENT: I.C. engine, pumping and lighting plant experience, &c.—Address, P8061, The Engineer Office. P8061 B

ENGINEER, with 16 Years' Good Record from responsible positions (general engineering), WANTS WORK, anywhere. Will accept any reasonable offer in works or office.—SNOAD, 36, York-road, Hitchin. P8087 B

GENTLEMAN, Speaks French, with London Connection and knowledge of continental rolling mills and foundries, would ASSIST REPRESENTATIVE on commission.—Address, P8065, The Engineer Office. P8065 B

MECHANICAL ENGINEER (21) SEEKS SITUATION as Assistant or any position in D.O. or workshops. Hard worker, energetic, good testimonials, university training, B.Sc.—Address, P8089, The Engineer Office. P8089 B

SITUATIONS WANTED (continued)

DESIGNING DRAUGHTSMAN (38), Competent Man, shop trained, widely experienced, DESIRES POST; specialist in new and original design, all classes machinery; temporary work accepted.—Address, P8092, The Engineer Office. P8092 B

DRAUGHTSMAN (Mechanical), Wide Experience in design and lay-out of various industrial plants, power station design, general engineering, DESIRES SITUATION.—Address, P8060, The Engineer Office. P8060 B

DRAUGHTSMAN, with General Experience, SEEKS POSITION in London or district. Also good Surveyor and Leveller.—Address, P8090, The Engineer Office. P8090 B

REFRIGERATION. — ENGINEER DRAUGHTSMAN, with wide technical and practical experience in refrigeration work of all descriptions, also a knowledge of commercial side, SEEKS responsible POSITION with progressive firm, inside or as outside representative. Moderate salary, ex. refs., age 46.—Address, P8085, The Engineer Office. P8085 B

MACHINE SHOP FOREMAN (40) SEEKS RE-ENGAGEMENT, home or abroad; well up in engine work, various classes machine tools and repair work, conversant with various methods of piecework, and can produce first-class testimonials.—Address, P8075, The Engineer Office. P8075 B

PRESS SHOP and TOOLROOM FOREMAN, Age 37, exceptional experience in light and heavy pressings, automobile and electrical manufacture, good organiser, strict disciplinarian, good timekeeper; highest references.—Address, P8078, The Engineer Office. P8078 B

MILLWRIGHT (40) SEEKS WORK in Country or small town; all-round mechanic, own tools, life abstainer, single.—Address, P8059, The Engineer Office. P8059 B

CLERK SEEKS SITUATION, London or District office. Bookkeeping and any description office work. Good experience general engineering and small tools.—Address, P8079, The Engineer Office. P8079 B

PARTNERSHIPS

PARTNERSHIPS ENGINEERING AND BUSINESSES.

Wheatley Kirk, Price & Co.

46, Watling Street, London, E.C. 4.

Established seventy years.

TRAINED ENGINEER REQUIRES DIRECTORSHIP or similar employment; 6 years' railway work, 8 years' experience administrative work. Good organiser, wide knowledge of production and supply of engineering materials and textiles, intimate knowledge of motor trade.—Principals only need apply, Box "L," c/o Geo. Kelly and Co., 14, Victoria-street, S.W. 1. 3653 C

AGENCIES

COMMERCIAL ENGINEERS, Exporting Through London merchants to China, Burmah, India, Africa, and West Indies, &c., have excellent opportunity to offer additional Constructional Engineering and Building Materials, especially Constructional Steel. Correspondence direct with manufacturers would be welcomed.—Address, 3607, The Engineer Office. 3607 D

ENGINEER, with Leeds Office, Connection Amongst E Yorks. power stations, mills, municipalities, collieries, works, &c., DESIRES to NEGOTIATE with Firm of repute for REPRESENTATION.—Address, P8073, The Engineer Office. P8073 D

ENGINEERING FIRM, Manufacturing a Boiler speciality, well known and extensively used, is PREPARED to CONSIDER APPLICATIONS from AGENTS having sound connections amongst steam users in Lancashire, Yorkshire, and North-Eastern Counties.—Address, 3656, The Engineer Office. 3656 D

EXPERIENCED LONDON AGENT, with Extensive connection amongst buyers of pumping machinery, OFFERS SERVICES to First-class MAKER with wide range of types.—Address, P8080, The Engineer Office. P8080 D

REPRESENTATIVES REQUIRED in all Principal towns to sell Heat Insulating Bricks.—Replies to Box 684, Advertising Offices, 84, Queen Victoria-street, London, E.C. 3660 D

STEEL AND SMALL TOOLS.—WANTED, BUYING AGENTS for following countries:—Australia, Canada, Africa, and India. Exceptional opportunity. —Address, P8086, The Engineer Office. P8086 D

WORLD TRAVELLER, Representing Important British engineering manufacturers in five continents, is OPEN to REPRESENT MANUFACTURE of any class of Machinery except power plant.—Address, P8012, The Engineer Office. P8012 D

MISCELLANEOUS

WANTED.—"HISTORY and PROGRESS of STEAM ENGINES," by Elisha Galloway, Thos. Kelly, 1829 or 1833; "HIGH-PRESSURE STEAM," by H. H. Powells, Constable and Co., 1905. —Address, 3633, The Engineer Office. 3633 I

DESIGN REQUIRED for Extremely Light-weight GENERATOR for 100 volts, 10 amps., for medical purposes; would be in use 15 to 20 minutes only periodically.—Write, COOPER, 25, Holborn-viaduct, E.C. 1. P8063 I

WANTED TO PURCHASE.

INSTITUTION OF CIVIL ENGINEERS.—Messrs. Batsford are DESIROUS of PURCHASING COPIES of Vols. CCIX., CCX., CCXI., CCXII., CCXIII., CCXIV., and continuing volumes of the "MINUTES of PROCEEDINGS" of the above Institution, and would thank anyone possessing such to communicate with them.—B. T. BATSFORD, Ltd., Booksellers, 94, High Holborn, London, W.C. 3621 I

IF YOU REQUIRE
DIVIDING HEADS for MILLING,
ROTARY TABLES for
SLOTTING and MILLING.
Write to
THE WHEELER MNFG. CO. Ltd.,
65F, Trench Crossing, Wellington, Salop.

TRADERS SEEKING

SITES FOR NEW WORKS

SHOULD CONSULT THE

LONDON & NORTH EASTERN RAILWAY Co.'s

INDUSTRIAL AGENT

for information respecting vacant land, local rates, housing and labour conditions, accessibility of site, means of transport—in fact all that there is to know with regard to setting up new works in the huge area served by the Company.

Enquiries should be addressed:—
INDUSTRIAL AGENT,
L N E R,
KING'S CROSS STATION,
LONDON, N. 1.

EDUCATIONAL

ARTICLED PUPIL.—A CIVIL ENGINEER has A VACANCY for well-educated Young Gentleman as PUPIL. Good practical and theoretical training. Interesting works in hand. Premium required.—Address, 3611, The Engineer Office. 3611 H

CORRESPONDENCE COURSES for Inst. C.E., Inst. Mech. E., London Univ. (Matric., Inter. and B.Sc.) personally conducted by Mr. TREVOR W. PHILLIPS, B.Sc. (Honours), Assoc. M. Inst. C.E., M.R.S.I., F.R.S.A., &c. Also Day Tuition in Office. Excellent results at all Exams. Courses may commence at any time.—8/11, Trafford Chambers, 55, South John-street, LIVERPOOL. Ex. H

ENGINEERING EXAMINATIONS.—Day, Evening or Correspondence Courses of Preparation for all Examinations. Thousands of successes during the past eighteen years. — G. P. KNOWLES, M.B.E., B.Sc., A.M.I.C.E., &c., 39, Victoria-street, Westminster, S.W. 1. Ex.

ENGINEERING SALES MANAGERS.—Our Special Course of Training qualifies students for posts of unlimited scope in this lucrative field. We are prepared to arrange introductions between employers and our trained candidates.—Apply, The INSTITUTE of ENGINEERING SALESMANSHIP, 333, Oxford-road, Manchr. P7982 H

LEARN SURVEYING AND LEVELLING.—Thorough practical instruction given by an expert. —Address, E. MOUL (late L.S.W. and S.F.D. Rlys.), Hollybank, Woking. P7852 H

TO STEEL WORK DRAUGHTSMEN.—A Few Hours' Daily TUITION REQUIRED in Constructional Steel Work and Steel Roofs by young fellow.—Address, stating terms, 3547, The Engineer Office. 3547 H

TUITION BY POST.—Inst. C.E. and I. Mech. E. Enrol now for next Exams.; 100 per cent. passes last examination. Reinforced Concrete, new comprehensive course under expert engineer, £3 3s. Write for particulars.—PENNINGTONS, University Tutors, 184, Oxford-road, Manchester. Estab. 1876. Ex.

PATENTS

THE PROPRIETOR of BRITISH PATENT No. 152,331, dated October 9, 1919, relating to "Improvements in Dish-washing Machines," is DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or otherwise on reasonable terms for the purpose of EXPLOITING the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. SINGER, Steger Building, Chicago, Illinois. 3590 H

THE PROPRIETOR of BRITISH PATENT No. 26,296/13, dated November 17, 1913, relating to "Sheet Metal Culverts," is DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or otherwise on reasonable terms for the purpose of EXPLOITING the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. SINGER, Steger Building, Chicago, Illinois. 3561 H

THE PROPRIETOR of PATENTS 158,300, relating to "IMPROVED SLOW-SETTING CEMENT AND METHOD OF PRODUCING SAME," 155,431, both dated Nov. 8, 1919, relating to "IMPROVED SLOW-SETTING, FAT AND WATER PROOF CEMENT AND METHOD OF PRODUCING SAME," is DESIROUS of ENTERING into ARRANGEMENTS by way of LICENSES or otherwise on reasonable terms for the purpose of EXPLOITING the above patents and ensuring their practical working in Great Britain. —Inquiries to B. SINGER, Steger Building, Chicago, Ill. 3633 H

THE PROPRIETOR of BRITISH PATENT No. 121,956, dated 4th October, 1917, for "Improvement in Electric Welding," is DESIROUS of ENTERING into NEGOTIATIONS for the SALE of the Patent or for GRANTING LICENCES for the EXPLOITATION of the invention in Great Britain on reasonable terms.—All communications to be addressed to MEWBURN ELLIS and CO., 70/72, Chancery-lane, London, W.C. 2. P8067 H

THE PROPRIETORS of LETTERS PATENT Nos 120,010, 119,131, and 118,401, relating to ROCK DRILLING MACHINES, DESIRE to DISPOSE of their PATENTS or to GRANT LICENCES to interested parties on reasonable terms for the purpose of EXPLOITING the same and ensuring their full commercial development and practical working in this country.—Inquiries to be addressed to CRUIKSHANK & FAIRWEATHER, of 65-66, Chancery-lane, London, W.C. 2. 3615 H

THE PROPRIETORS of the PATENT No. 152,360, for "Improvements relating to the Conveying of Pulverised Material," are DESIROUS of ENTERING into ARRANGEMENTS by way of LICENCE and otherwise on reasonable terms for the purpose of EXPLOITING the same and ensuring its full development and practical working in this country.—All communications should be addressed in the first instance to HASELTINE, LAKE and CO., Chartered Patent Agents, 28, Southampton-buildings, Chancery-lane, London, W.C. 2. 3634 H

THE PROPRIETORS of LETTERS PATENT No. 22,212/1912, relating to THREADING DIES, DESIRE to DISPOSE of their PATENT or to GRANT LICENCES to interested parties on reasonable terms for the purpose of EXPLOITING the same and ensuring its full commercial development and practical working in this country.—Inquiries to be addressed to CRUIKSHANK & FAIRWEATHER, of 65-66, Chancery-lane, London, W.C. 2. 3616 H

AN IMPORTANT MASTER PATENT IN AVIATION
For GREATER SAFETY of OUR AIRMEN and GENERAL PUBLIC.
EITHER WAR, BUSINESS, OR PLEASURE.
ABSOLUTELY GENUINE. ILLNESS ONLY REASON FOR DISPOSAL.
Replies, "Aeronautical," P8062, The Engineer Office.

FOR HIRE

FOR HIRE, PUMPS and WELL-BORING TOOLS for Contractors' Deep Wells, &c., 2in. to 24in. dia.—R. RICHARDS and CO., Upper Ground-street, London, S.E. Telephone No., 978 Hop. 822 K

FOR SALE or HIRE, ELECTRIC MOTORS, from 60 to 300 H.P.; PORTABLE STEAM ENGINES, from 8 to 40 N.H.P.; STEAM BOILERS, CRANES, PUMPS, MACHINE TOOLS of every description; reasonable terms, immediate delivery.—J. T. WILLIAMS and SONS, 57, Queen Victoria-street, London, E.C. Tel., City 3938. Ex

For continuation of Small Advertisements see page 3

A Seven-Day Journal

The Port of Paris.

THE elaborate scheme which, when completed, will make Paris a great inland port, has been carried a step farther towards execution by a recent decision to expropriate 64 acres of land at Gennevilliers, below Paris, after failure to acquire the land by private contract. This area is to be added to the 880 acres of ground which the Department of the Seine has already purchased in connection with the scheme. The chief feature contained in the proposals is the creation of the Port of Gennevilliers, which will be in direct communication with the sea by way of the lower Seine. This port will have two groups of docks. The normal depth of water will be 16ft. 5in., and the top of the quays will be above the highest recorded flood level, that reached in 1876. There will be two other ports. One at Bonneuil, on the Marne, will receive the traffic of the Marne and the Upper Seine. The other at Pantin, on the Ourcq Canal, will be linked up with the Canal du Nord. The Port of Bonneuil was begun during the war, and, it is expected, will shortly be completed. It is being constructed by the Paris Chamber of Commerce on behalf of the Department of the Seine, and will have four docks nearly 1000ft. long. The Ourcq Canal is to be widened at Pantin to increase the accommodation for shipping. All the new docks are to be linked up with the existing railway systems.

An Encyclopedia of Imperial Trade.

THE task which the Federation of British Industries has set itself in the preparation of a thorough survey of the Empire's commercial resources and possibilities, particularly in view of the fact that an endeavour is to be made to publish the volumes next spring in time for the opening of the British Empire Exhibition, is one of ambitious magnitude, but, nevertheless, of clear and undoubted value. The Federation has secured the co-operation of the different Governments of the Empire, and is aiming at the production of a work of reference giving all the available information regarding the resources and requirements, present and prospective, of the component parts of the Empire for the benefit of the producer, the manufacturer, the merchant and the financier. The work, we gather, will be issued in ten volumes, some of which will consist of two parts. Those of chief interest to engineers would appear to be Vol. VI., Fuels; Vol. VII., Metals and Minerals, and Vol. X., Communications. From information supplied to us regarding the general plan to be followed in the compilation of each volume we feel convinced that, given effective execution, the volumes will be invaluable to all interested in inter-Imperial trade and seeking to extend their participation in it. The work is one well worth undertaking, and we look forward with great pleasure to its fruition.

The U.S. Shipping Board's Fleet.

FIGURES published by the United States Shipping Board reveal the magnitude of the loss which the country has sustained in connection with the vessels built during the war emergency and since laid up to await disposal. On July 1st the Board owned 1340 vessels, valued at, roughly, £46,000,000. Of these vessels, 416, valued at about £28,000,000, were in service or were ready for immediate sale and delivery. The remainder consisted of 36 tugs, some of which were in service, and 882 other vessels valued at some £18,000,000, which were laid up in various conditions of repair. Of the vessels in service or ready for sale, 365 were cargo ships, 19 were tankers, and 30 were passenger ships. Among the idle vessels were 802 cargo ships, 26 tankers, 9 concrete ships, and 3 passenger ships. Altogether it would appear that the Board's fleet is now worth about one-twelfth of the sum expended on its construction.

The "Marie Louise" Class of Ship.

WHEN the French vessel Deputé Emile Driant was lost in the English Channel a month or so ago—a disaster in which nineteen of those on board her perished—nautical circles in France were sharply aroused, for she was the fourth of the "Marie Louise" class to perish. Eleven sister vessels are still in service. Following the third disaster in April, 1922, a committee was appointed by the Under-Secretary for the Mercantile Marine to consider the cause of the accidents. That committee came to the conclusion that with certain alterations the type was fully seaworthy. The alterations recommended were carried out in the case of the Deputé Emile Driant, but did not prevent her from meeting the same fate as her three sisters. A new committee has now been appointed to investigate matters again, and it is being strongly urged that this second body should base its findings on the results of practical experiments, rather than upon theoretical considerations. The vessels were designed by the French Admiralty, and were built some in private and some in the naval dockyards. They have a length of 266ft. 8in., a breadth of 39ft. 4in., a depth of 22ft. 11in., and a gross tonnage of about 2310 tons. It has been suggested that the vessels lost had an exceptionally short rolling period; that the capacity of the holds was excessive relatively to the deadweight capacity of the ships, and that in rough weather the cargo was apt to move to an abnormal degree.

International Seaplane Race.

TO-MORROW (Saturday) the international seaplane race for the Schneider Cup will be held over a course of 188 nautical miles, starting from Cowes. Eight machines have been entered for the contest, three from the United States, three from France, and two from Great Britain. The American machines—two Curtiss and one Wright—are naval seaplanes, and will be piloted by naval officers. The British machines are the Sea Lion II., entered by the Supermarine Aviation Works, Limited, and practically identical with the machine which won the cup last year, and the Blackburn Pellet, entered by the Blackburn Aeroplane and Motor Company, Limited. Both are flying boats as distinct from the float type of seaplane. The Sea Lion is credited with a speed of about 170 miles an hour. The Pellet is a new design, and is expected by the makers to reach a speed of 180 miles an hour. Both these machines are fitted with a 450 horse-power Napier "Lion" engine. A third British machine, a Sopwith, was entered, but met with a mishap and has been withdrawn. One of the American seaplanes met with a mishap during a trial flight on Monday, but a reserve machine has been brought over and will take its place. The contest is not merely one of speed. On the day before it takes place the conditions require that the machines shall undergo "navigability" tests by making short flights, taxi-ing on the water at a speed not less than 12 miles an hour and lying at moorings, unattended, for 6 hours. Minor adjustments alone are permitted between these preliminary tests and the final race, so that it is quite possible that with the choppy water of the Solent some of the competitors may be eliminated before to-morrow's actual race.

The British Industries Fair, Birmingham.

ALTHOUGH the British Industries Fair at Birmingham is run in close conjunction with the British Industries Fair at London, the two shows are under entirely different management, the London Fair being organised by the Department of Overseas Trade and the other by a body known as the British Industries Fair (Birmingham), Incorporated. The Birmingham organisation dates from December, 1914, when the question of holding a great annual trades fair was brought before the Birmingham Chamber of Commerce. National interests prevented the first fair being held before 1920. Meanwhile the General Purposes Committee of the Chamber of Commerce, strengthened by co-option, formed a council for the organisation of the Fair, which council later assumed the title given above. Under its auspices four successful Fairs have been held at Castle Bromwich. In spite, however, of the fact that any surplus realised from one Fair can only be applied to the development of subsequent Fairs, the Inland Revenue authorities have claimed from the incorporated body large sums by way of excess profits tax and income tax. To meet this situation the incorporation has now decided to go into voluntary liquidation and to allow the entire control and organisation of the Fairs to revert to the Chamber of Commerce. It will be under the management of the parent body that next year's Fair will be held from May 12th to May 23rd. As usual, the ranges covered by the exhibits will be selected so as not to clash with those to be shown at the London Fair.

A New Air Service.

ON Tuesday the first trip of a new daily British air transport service was opened. On that day a Supermarine flying boat made its first regular trip between Southampton and Guernsey. According to the schedule, the machine is due to depart outward daily at 11.15 a.m. and to alight at St. Peter Port about an hour and a-quarter later. A return journey is made in the afternoon, Guernsey being left at 3.30 p.m. and Southampton being reached in ample time to permit the catching of the 5.26 p.m. train for London. The adult passenger fare for the single air journey is £3 18s., with 30 lb. of luggage free.

The Boilermakers' Dispute.

STEPS of a significant nature have been taken during the week towards effecting a settlement of the prolonged and disastrous dispute between the Boilermakers' Society and the Shipbuilding and Engineering Employers' Federation. On Thursday of last week the Federation of Engineering and Shipbuilding Trades—from which body the Boilermakers' Society was expelled in consequence of its refusal to accept the national overtime and night-shift agreement—held a meeting in London for the purpose of drafting rules for the Federation's new constitution, a revision of which was rendered necessary by the Boilermakers' expulsion. A second conference was held in the evening of the same day, at which representatives of the boilermakers were present. No report was issued as to the result of this second conference, but the fact that the Federation and the Boilermakers' Society had met was regarded as a hopeful sign. On the following day it was officially announced that the Minister of Labour had invited the Federation, the boilermakers and the employers to meet him on Monday to discuss the situation, the invitation, it was subsequently revealed, being the outcome of a resolution passed by the Federation of Trades at its Thursday meeting to the effect that efforts should be made to bring the employers and the Boilermakers' Society together with the object of settling the dispute. The meeting duly took place, the Minister receiving the three bodies separately. What progress was made as a result of the discussions was not indicated, but it was later intimated that the employers had received a request from the Federation to meet its representatives and that they had agreed to do so to-day (Friday) at Carlisle.

A Large Oil-Electric Station.

YESTERDAY (Thursday) an extension of the Dundalk District Council's power station was formally opened. The plant in the extension comprises a 500 horse-power Vickers-Petter hot-bulb engine using crude oil coupled to a 340-kilowatt Metropolitan-Vickers generator. The complete plant at the station now comprises six oil engines having a total output of 1600 brake horse-power, the dynamo output being 1080 K.W. It is claimed that the station as it now exists is one of the largest of its kind, that is, wholly operated on liquid fuel, in Great Britain or Ireland. A total sum of nearly £70,000 has now been expended on the station. In comparison with other Irish towns Dundalk would appear to be well supplied with electricity. For the year ending March 31st, 1922, the annual output averaged out at 92.6 units per head of the population, whereas Londonderry's output averaged 75.2 units, Belfast's 42.7, Dublin's 32.9, and Rathmine's 21.7. The high figure revealed for Dundalk may perhaps be accounted for by the fact that the station is called upon to supply the energy required by the local locomotive works of the Great Northern of Ireland Railway Company.

Miners' Wages.

ON Wednesday of next week the executives of the Mining Association and the Miners' Federation are to meet to discuss certain proposals advanced by the men's representatives for the amendment of the wages agreement in the coal mining industry. From some statistics originating with the employers we gather that in three of the coal mining districts—Northumberland, Durham and Scotland—wages are now at a higher level relatively to those paid in 1914 than the present cost of living figure, 173, bears to the pre-war value of 100. In nine districts employing a total of 971,110 men, or 85 per cent. of the whole number engaged in the industry, the wages paid, corrected for the increased cost of living, correspond to 90 per cent., or more, of the 1914 wages. The best paid district is Northumberland, and the worst North Wales. Over the whole of England, Wales and Scotland, the average wage now being paid is 10s. 8.35d. per shift, as compared with 6s. 5.64d. in 1914.

A Scottish Colliery Disaster.

ONE of the most serious mining disasters of recent years occurred early on Tuesday morning at the No. 23 Redding Pit of James Nimmo and Company, Limited, between Falkirk and Polmont. It was caused by the inrush of water from the old workings of an adjoining pit. At the time of the accident sixty-six men were working in the mine on the night shift, and it is feared that out of this number forty-two have lost their lives by suffocation or drowning. Six men were able to make their way to the surface, and rescue work was immediately begun, special assistance being summoned from the mine rescue stations at Coatbridge and Larbert. Operations were rendered very difficult by the extensive flooding and the presence of "black damp," but later in the day of the accident another group of men was raised from a disused shaft half a mile away from the Redding shaft. Larger pumps were requisitioned, and every effort was made to reduce the water level and give access to the workings, but it is feared that there remains little hope for the forty-three men trapped in the mine.

Bridge Building in China.

NEWS has just been received in this country of an important contract for bridge building in China which is open to tender, and in view of the fact that it is for the northern territory, where British engineering firms have not secured many orders within the past year or so, it is to be hoped that our manufacturers may be successful in the face of the inevitable continental competition. It is for a bridge which it is proposed to build across the Hai Ho River at Tientsin at a cost of, approximately, £120,000. The bridge is to be of the opening type and have accommodation for two tramway tracks and two cart roads. The total length will be 306ft., and the fairway for shipping 140ft. wide. Tenders must be with the Hai Ho Commissioners by May 1st, 1924.

Science and Industry in America.

By WALTER ROSENHAIN, D.Sc., F.R.S.

No. III.*

ALUMINIUM AND LIGHT ALLOYS.

THE aluminium industry, being comparatively modern in origin, has never had any rule-of-thumb traditions to overcome, and one would anticipate that in such circumstances scientific methods would everywhere hold complete sway. In the American industry this appears to be to a considerable extent true. The writer did not have an opportunity of visiting the reduction plants where the metal is actually produced, but an important part of the industry, which is situated at Cleveland, Ohio, and deals with the manufacture of light alloys in various forms, came under his observation. In the works of the Aluminium Company of America, particularly, there was ample evidence of the far-reaching application of scientific methods, not only in the industrial processes, but in regard to actual research. The scientific metallurgist in charge of this work is well known as one of the leading figures of American metallurgy, Dr. Z. Jeffries. The position which he undoubtedly occupies in the American metallurgical world, connected as he is with the manufacture both of aluminium alloys and of tungsten, is strikingly indicative of the general status of the science of metallurgy in the country. Its leaders, even from the scientific point of view, are to be found rather in industry than in the laboratories of colleges or public institutions.

While it may perhaps be fairly claimed that a large amount of the fundamental and pioneer work of metallurgical research, particularly in regard to aluminium alloys, has been done in England, there can be no doubt that the results of that work have been, and are being, more fully exploited in America under highly competent scientific guidance. In the works of the Aluminium Company of America is a well-equipped forging and heat-treatment shop, in which light alloy drop forgings are produced on a large scale and are heat treated—in some cases subjected to double heat treatment—in electrically heated and automatically controlled furnaces. This is perhaps in part to be explained by the restrictive effects of certain patents in this country, which are not, it would seem, permitted to interfere with this kind of development in America.

At all events, a considerable number of light alloys are being produced and used in which the fundamental principles of heat treatment, which have been largely elucidated by English research, are being fully utilised. Aluminium alloy connecting-rods in motor car engines are now standard practice in a number of American cars. The great advantages of lightness and high thermal conductivity, leading to the cooling of the bearings, coupled with very ample strength, are fully appreciated. In England only a very few designers have as yet adopted this improvement. At the same time, some of the alloys used for this purpose in America are not quite those which afford the highest combination of lightness and strength; cheapness and facility of production seem to be overriding factors at the present time. Ultimately, however, when designers have acquired more experience and with it more confidence in the new materials, their demands upon the strength of the alloy are bound to increase, and there can be no doubt that demands much more stringent than those yet specified can and will be met.

Thanks to actual research of a high order and to the courageous application of its results, there can be no doubt that light alloy practice in America is distinctly advanced. In this matter it has long been a cause for regret that the results of our own extensive researches are not finding industrial application to anything like the desirable extent, a complaint which, in the past, has often been heard in England. The American example in this particular field is one which deserves the careful attention of those concerned with the production and use of aluminium and its alloys in this country.

While dealing with aluminium and its alloys mention may perhaps be made of those alloys of aluminium which are frequently called "aluminium bronze." The most exhaustive investigation of the copper-aluminium alloys and of these alloys with the addition of manganese has, again, been carried out in England, and the eighth and ninth reports of the Alloys Research Committee contain a large amount of data establishing the remarkably useful properties of these materials. None the less—or is it perhaps for that very reason?—these important materials have found nothing more than isolated applications in this country. It is therefore very instructive to see that their practical application has been carried very much further in America. There seems to be no doubt that the use of these alloys involves some preliminary difficulties which have to be overcome before their industrial production becomes practicable. This stage has, however, been passed in America, and both in the cast and wrought state the materials are now in really important use. Forgings of considerable size are used for certain types of gun mounting, the pure copper-aluminium alloy containing 10 per cent. of aluminium being employed for this purpose. Further, a well-known make of automobile is fitted with a worm wheel of the same material. In the works of the American Brass Company a considerable body of slabs of this alloy were being passed through the mills for various purposes, in spite of the fact that the alloy is found to cost nearly twice as much as ordinary brass. While it is important to keep scrap containing aluminium out of all brass and bronze, owing to the effect which it has in causing porosity, the company named does not appear to be in fear of such contamination, a confidence which is fully justified by its highly organised methods of dealing with scrap, both in the plant and in the laboratory. For casting purposes an alloy containing rather less aluminium, but with the addition of 3 per cent. of iron, is finding considerable use owing to the remarkable strength of the material, its resistance to corrosion, and particularly to oxidation at fairly high temperatures. Here, again, is a product of research which is finding application, but not in the country where the greater part of the research has been carried out.

Beyond aluminium, attention is also being given very seriously to the still lighter alloys of magnesium. There are, of course, well-known difficulties in the use of this metal, one of the chief troubles arising from the readiness with which magnesium and its alloys undergo corrosion. Ordinary magnesium is itself bad enough in this respect, and some of its most desirable alloys from the point of view of strength—viz., those with aluminium and with zinc—are still more sensitive. It seems, however, as a result of American research, possible that this excessive corrodibility is not inherently a property of the metal itself, but is in some measure dependent upon the mode of preparation by which it has been obtained. Ordinary magnesium is produced by electrolysis of salts in which chlorine or fluorine is present. Recently, however, a variety of pure magnesium has been produced in America from electrolytes free from chlorine, and this metal, it is said, does not corrode nearly so readily. In proof of this statement Dr. Jeffries kindly presented the writer with a very beautiful specimen of crystallised magnesium metal which in appearance resembles silver. This actual specimen had already retained its brightness, although freely exposed to the air of Cleveland, for a number of months. It still preserves its bright silvery lustre on the natural facets of the crystals, after transport across the Atlantic and several months' further exposure to the air, treatment which would have covered any ordinary sample of the metal with a thick layer of white oxide or carbonate. The exact cause of this very striking difference in behaviour has not yet been elucidated, but that traces of chloride probably remain in the ordinary metal and lead to its rapid corrosion seems to be indicated.

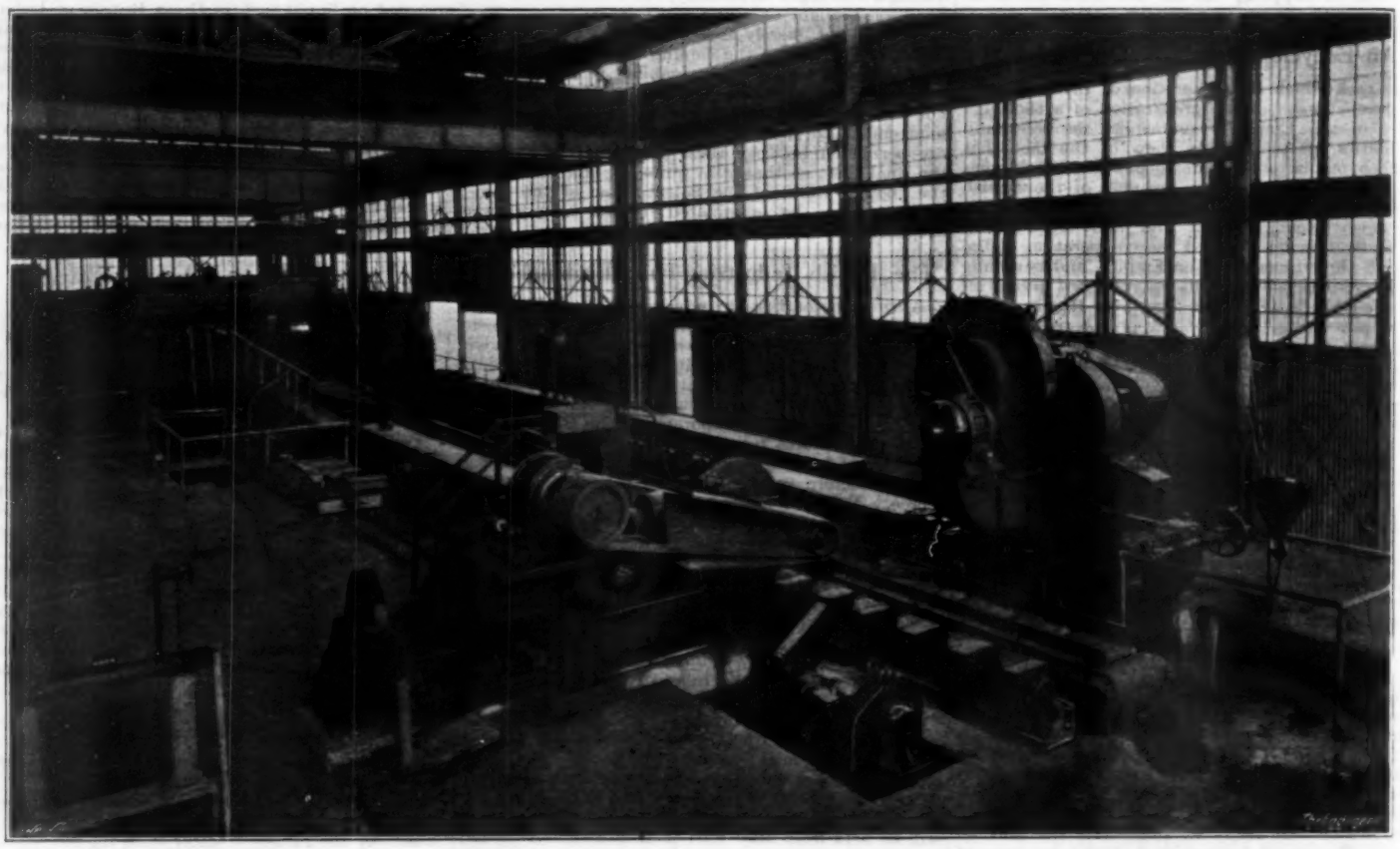


FIG. 3—HUNTINGTON NICKEL ROLLING MILL

NICKEL AND MONEL METAL.

The American production of nickel, derived mainly from Canadian ores, was, of course, enormously stimulated during the war. Since then the demand for most purposes has dropped to a relatively low level, mainly owing to the cessation of armament production in nickel steel and in cupro-nickel for bullet mantles. As a result the works dealing with nickel have been very greatly reduced in number and output, but it is characteristic to find in an industry in this difficult position a particularly modern and well-designed and equipped new plant like that of the International Nickel Company, at Huntington, West Virginia. Not only that, but the company in question is also making vigorous efforts to employ scientific methods in its industry on a considerable scale.

* No. II. appeared September 21st.

This is evidenced by the fact that it has secured the services of a well-known metallurgist formerly in the service of the Bureau of Standards, and is engaged in an endeavour to find new uses and markets for nickel and its alloys. Such an effort, made in a time of commercial difficulty, is particularly remarkable and indicates a wisdom not often met in such cases. The development of new uses is essentially a question for scientific metallurgical research, and if this side of the company's activities is pursued in the same modern spirit as the design and equipment of their new plant, ultimate success must be certain. The work had, however, not progressed far enough at the time of my visit to allow of results being visible. At the Huntington plant, however, a well-equipped works laboratory is installed and a large amount of interesting work of a detailed nature is being carried out. The plant itself, although of purely engineering and metallurgical rather than scientific interest, is sufficiently remarkable to deserve special notice. The most striking feature is a new electrically driven and controlled rolling mill for the hot rolling of relatively large—two-ton—ingots of nickel. This whole mill is almost entirely automatic. The hot ingot, taken from the furnace by a crane, is placed on live rollers and propelled towards and into the rolls, which are of the two-high non-reversing type. As the ingot or billet passes through the rolls it runs on to an inclined table, which, as soon as the whole piece is clear of the rolls, rises, and, again by means of live rollers, pushes the billet back over the top roll. On the other side of the rolls the live roller table has meanwhile also risen and is ready to receive the billet. This table then drops and the billet is again pushed into the rolls. A system of this kind, involving the use of rising and falling tables, is in use on a much smaller scale in many American brass mills, but the interesting point about the Huntington mill is the fact that the whole of the operations are electrically controlled by a "driver" placed upon a bridge overlooking the mill, whence he carries out the operations by merely manipulating electrical switches. On the mill proper two men only are engaged, mainly in providing a little extra guidance to the billet at intervals as it is moved from one of the passes in the rolls to another. To see the whole of the rolling operations on such a scale carried on by only four men is really remarkable. A photograph of this mill in action has been kindly presented to the writer by Mr. Wadhams, of the International Nickel Company, and is reproduced in Fig. 3.

Monel metal is also handled at Huntington. This well-known alloy has been very much pushed both in America and elsewhere, and remarkable claims are made for it. Some of these claims, based on the fact that it is a so-called "natural" alloy obtained by the direct reduction of a composite ore, can scarcely be taken very seriously by a scientific metallurgist, but the natural occurrence of such an ore undoubtedly gives a considerable advantage to the alloy from the viewpoint of cost. The valuable and in many ways remarkable properties of the alloy are, however, well known; they do not seem as yet to have received very careful scientific study or investigation, so that it is quite probable that a variation of composition might lead to the development of an even superior grade of material. Doubtless the scientific activities of the International Nickel Company, to whose beginnings reference has already been made, will be extended in this direction also.

THE NON-FERROUS METAL INDUSTRIES.

Taking the non-ferrous metals industries as a whole, it will be seen that a great deal of detailed scientific work is being done in connection with various manufacturing concerns, and that in some respects an advanced stage has been reached. Most of this work, however, is of a very immediate "bread-and-butter" order. There is very little fundamental research work on non-ferrous alloys in progress, and much of the science which is being applied in this industry in America is derived from England and elsewhere. This state of affairs is further emphasised when the activities of the colleges and universities and of the public laboratories are considered, and finds its reflection in the relative positions of the American and the British Institute of Metals. The former was founded by a group of enthusiastic metallurgists in America, including such men as Basset, Price, Corse, Jeffries, Matthewson, and others more or less in emulation of the British Institute, although many of the leading American non-ferrous metallurgists are also members of the British Institute of Metals. Unfortunately, the American Institute did not succeed as well as was hoped, and as a result of financial difficulties was forced to amalgamate with the very large, important and powerful American Institute of Mining and Metallurgical Engineers. As a consequence the American Institute of Metals Division is now but a minor branch of a very large institution whose main interests are centred in mining engineering. In spite of the fact that the Institute of Metals group is a very active one, its situation cannot, admittedly, bear comparison with the status of the British Institute of Metals. The state of non-ferrous metallurgical research in America can be gauged from the fact that the American Institute finds a difficulty in obtaining an adequate supply of papers of reasonably high quality, while the two annual volumes of the British Institute have grown steadily in size and have maintained a quality which secures a very gratifying degree of appreciation among American metallurgists themselves. This state of affairs surely points to "something wrong" in these matters on both sides of the Atlantic. Here there is much research of admittedly high quality, but relatively little immediate application of the results obtained; in America, on the other hand, there is great readiness to apply scientific methods and results, but a lack of adequate research. It would seem to a somewhat hurried observer that the American industry has need of some considerable effort to right its position, since permanent advancement can scarcely be secured by continued reliance upon the efforts of others. The great electrical industries of America have solved this problem for themselves in a most striking manner by the establishment of large individual research laboratories, such as those of the General Electric Company, the Westinghouse Company, and the Western Electric Company. It may be that no one of the non-ferrous companies is sufficiently powerful to undertake the establishment of a corresponding research laboratory for non-ferrous metals, although the great Anaconda Company cannot lag far behind the large electrical corporations in regard to resources. Be this as it may, it would seem that one such laboratory, run on co-operative lines by a group of non-ferrous interests, would be perfectly practicable and would go a long way towards solving this problem of making American non-ferrous metallurgy self-supporting in regard to research.

From a somewhat different point of view the establishment of a similar co-operative research laboratory by the British non-ferrous industries would be equally desirable. The point of view is, again, the one already stressed—the need of finding early and energetic applications for the results of research. If manufacturers were themselves directly concerned in the carrying on of research their interest in its results and the desire to utilise them might be greater. Something in this direction, as yet on a small scale, is being accomplished by the British Non-ferrous Metals Research Association, but that work can only be regarded as a small beginning. There are many well-known reasons why this country must always find it difficult to emulate American mass production; these same reasons, however, serve to intensify the need for scientific methods in works practice and for far more research than is yet being done even here. Where it is a question of quality production such aids are even more essential than where quantity is a primary consideration.

IRON AND STEEL.

The application of science to ferrous metallurgy in America finds its main development in the heat treatment of steel. It is a significant fact that the most active and the strongest of American metallurgical societies is the Society for Steel Treating. Originating in an exhibition of heat-treated steel products, which has become an annual event, this Society now has a series of strong sections or "chapters" in most of the larger industrial centres and the numerous members, mostly drawn from men engaged in various branches of industry, take a keen interest in the scientific as well as the practical side of the subject. The great development of the American automobile industry is responsible for this to a very large extent, since the use of heat-treated alloy steels for all the more important parts of American cars has become universal, so much so that the heat treatment of "straight" carbon steels and the extremely valuable results thus to be obtained are very much neglected, a neglect in which American practice does not differ much from our own.

The application of scientific methods to the heat treatment of steel finds its best expression, however, not in the "Proceedings" of any society, but in the works themselves. This can be seen very highly developed in the heat treatment of spring steel, whether in such a plant as that of Ford motors or in plants like that of Detroit Steel Products or the Perfection Spring Company at Cleveland. Careful pyrometric control of the hardening and temper "drawing" furnaces is universal, the skilled judgment of a workman being relied upon only in isolated cases for "odd jobs" of minor importance for which the setting up of a pyrometrically controlled furnace is not thought worth while. Only one such case, however, was observed. The pyrometric control apparatus is generally actuated by a number of thermo-couples installed in different parts of the furnace, working through one of the Leeds and Northrup instruments, which serve at once as potentiometer recorders and to actuate either a direct automatic control of the furnace or a system of signals by which the men operating the furnaces are guided. In the best examples a combination of both systems is employed. The potentiometer which records the temperature turns the fuel supply to the furnace either on or off as the temperature requires. This control is generally actuated by some form of electro-magnetic valve, and the supply of either gas or oil is generally either turned on full or cut off entirely; only rarely is a by-pass employed. The fuel supply itself is, of course, adjusted in such a way that cutting off and turning on does not occur very often. In addition, in some cases, these controlling instruments are centralised in a large control room and light signals are also actuated, indicating to those in charge, sometimes several hundred feet away from the furnaces under control, whether the fuel supply is "on" or "off" any particular furnace and whether its temperature is "normal" (white light), "high" (red light), or "low" (green light).

Further, in some cases, the time during which the pieces of steel undergoing heat treatment are exposed to the furnace temperature is also automatically controlled, the goods being automatically pushed through the furnace and out into a quenching bath by a suitably arranged conveyor. Very great uniformity in the "temper" of the resulting product is thus obtained. The product itself is further controlled by means of a hardness measurement, either by means of a Brinell ball impression or by a scleroscope reading, on each piece turned out. In one case the records from several hundred heat-treated automobile crank shafts showed variations well within ten points in the Brinell number.

A particularly interesting example of scientifically controlled heat treatment is installed for the production of watch and clock springs at the Ingersoll Company's plant at Waterbury. The steel, in this case a "straight" carbon steel, is used in reels of great length, and the strip from these reels is passed continuously, first through an electrically heated tube furnace maintained at the proper hardening temperature; after this the strip, which is in continuous motion, passes through the quenching bath, then through a second small electric tube furnace for tempering purposes, and is then finally cooled in another bath, after which it is cleaned and polished before being wound on the reels in which it passes into the construction shops. It may perhaps be suggested that the installation of the elaborate and somewhat costly appliances of this nature is only rendered possible by typically American mass production methods, and that it could not be adopted so readily where a variety of products in smaller numbers has to be turned out. This is perhaps an open question, since it does not seem by any means impossible or even difficult to adapt scientific methods of control and even automatic appliances to varying conditions. It is doubtless rather less simple, but the demand for uniformly reliable quality is difficult, if not impossible, to meet in other ways. On the other hand, it may with equal fairness be suggested that without such scientific control leading to the development of automatic processes, mass production would never have become possible. At all events, there can be no doubt that American skill and enterprise have taken very full advantage of modern metallurgical science and of the aids which physical science generally has placed at their disposal. Few, if any, of the fundamental discoveries have been made in America, and there is not, admittedly, at the present time any greatly outstanding school of ferrous metallurgical research in America, whether in the industries or outside in colleges or institutions; yet the use of metallurgical science is most fully realised and turned to account.

Design of Pontoons.

By K. S. DODD, M.C., B.A. (Camb.).

THE theory of the design of pontoons affords an interesting problem, and the following article outlines a method of procedure for the rectangular type.

One half of the section is isolated and the forces upon it due to the water and to the other half are considered. Fig. 1 shows the load diagrams on one half of the pontoon, which is taken as encastered at B. The top of the pontoon is assumed to be 1ft. beneath the surface of the water—a condition which represents the worst probable loading. The forces H_c and V_c and the moment M_c are assumed to be applied by the other half of the pontoon, and their values must be found. The moment of inertia of the section is assumed to be the same all round, except for a gusset in the bottom corner, which is supposed to be absolutely stiff compared with the remainder. The only information at our disposal is that the pontoon is similarly loaded about the centre line, and, fortunately, this is sufficient to discover the three unknowns.

In the first place, there is no reason why one half should afford vertical support to the other half. Therefore $V_c = 0$. Secondly, the distortion under load will be symmetrical about the centre line; that is to say, the change of slope from B to C will be zero. Now, since the area of a bending moment diagram gives the change of slope, the sum of the areas from B to C is zero. This gives the second equation. Thirdly, the horizontal deflection of C must be zero. That is to say, the sum of the moments of the bending moment diagrams about C is equal to nothing, the lever arms of the areas being measured vertically.

The bending moment diagram for the top of the pontoon consists of two parts, the upper or parabolic one being due to the water pressure, and the lower or rectangular one due to M_c. These are carried right round to B_1. On the side there are, in addition, bending moment diagrams due to water pressure and to the force H_c.

On the bottom there are three further diagrams:—(*a*) Due to upward water pressure; (*b*) due to the shear from the water load on the top; and (*c*) the

large triangular diagram caused by the applied load $\frac{w\,b\,h}{2}$. When considering slope and deflection, only the shaded portion of the bending moment diagrams are taken into account, the gusset being rigid.

Let h = height of pontoon.

b = width of pontoon.

n = ratio $\frac{\text{width}}{\text{height}}$

w = weight of water per unit volume.

$\frac{h}{3}$ = height of gusset

$\frac{n\,h}{6}$ = base of gusset.

The equations may be expressed algebraically as follows:—

(1) . . . . . $V_c = 0$

(2) . . . . . $\int \frac{M\,d\,x}{E\,I} = 0$

Whence—

$$\frac{w\,h^3}{9}\left[-\frac{2}{27}-\frac{n}{2}+\frac{23\,n^3}{72}\right] + \frac{w\,h^2}{3}\left[-\frac{4}{27}-\frac{n}{2}-\frac{n^2}{4}-\frac{35\,n^3}{432}\right] + M_c\left[\frac{2}{3}+\frac{5}{6}\,n\right] - H_c\,h\left[\frac{2}{9}+\frac{n}{3}\right] = 0.$$

(3) . . . . . $\int \frac{M\,y\,d\,x}{E\,I} = 0$

Whence—

$$\frac{w\,h^3}{9}\left[-\frac{16}{405}-\frac{n}{2}+\frac{23}{72}\,n^3\right] + \frac{w\,h^2}{3}\left[-\frac{2}{27}-\frac{n}{2}-\frac{n^2}{12}-\frac{n^3}{54}\right] + M_c\left[\frac{2}{9}+\frac{n}{3}\right] - H_c\,h\left[\frac{8}{81}+\frac{n}{3}\right] = 0$$

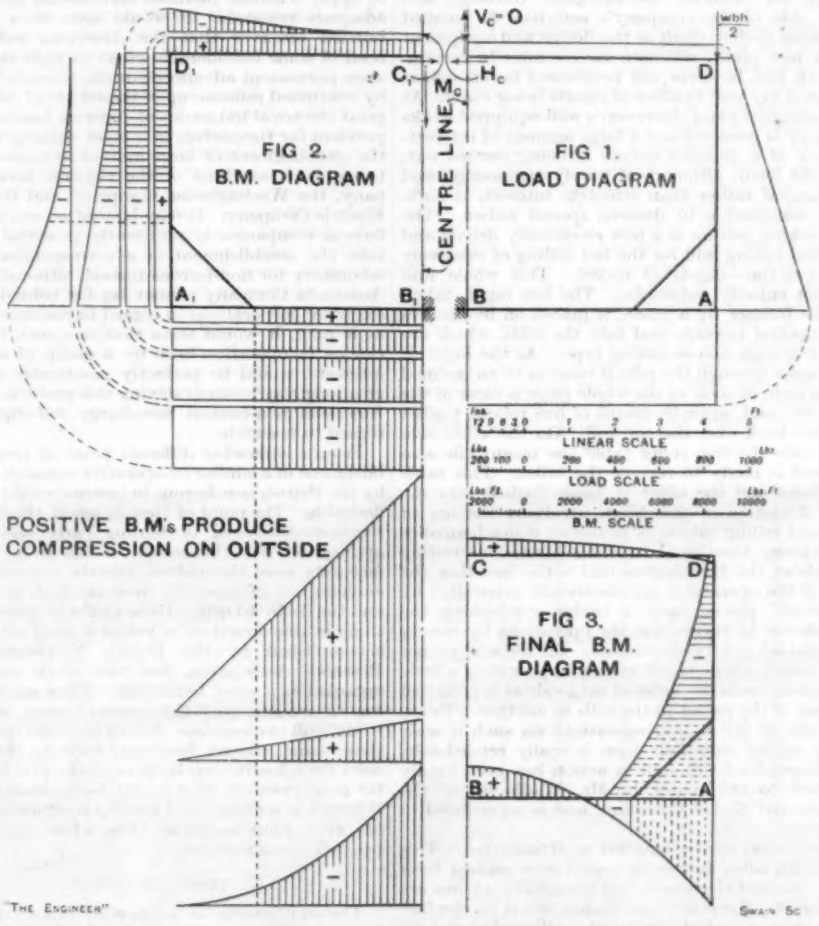
Having solved these equations for H_c and M_c, with particular values of n and h, it is a simple matter to draw all the bending moment diagrams to scale and then to add them to give the final bending moment diagram. Figs. 1, 2 and 3 represent a pontoon 11ft. wide by 5ft. 6in. deep, the diagrams being plotted for 1ft. run of the length.

The determination of H_c and M_c is a somewhat laborious process, and one that would have to be repeated were any change made later in the dimensions of the pontoon. To save calculation, a diagram, which is reproduced in Fig. 4 and which gives values of H_c and M_c for different sizes of rectangular pontoons, has been constructed. It should be noted that the use of this diagram enormously simplifies and shortens calculations for the design of rectangular pontoons similarly loaded.

In order to construct the diagram, the second and third equations were combined, and expressed in the form—

$$H_c = F_1(n)\,\frac{w\,h^2}{9} - F_2(n)\,\frac{w\,h}{3}$$

$$M_c = F_3(n)\,\frac{w\,h^3}{9} + F_4(n)\,\frac{w\,h^2}{3}$$



The relationship between n and its functions not being of a simple nature, it was thought advisable to draw curves to show it. This has been done in Fig. 4, n being shown on the vertical axis, while the scale for $F_{1234}(n)$ is horizontal, but is left unnumbered as the values of this quantity are of no practical interest.

If $F(n)$ and the corresponding term in $w\,h$ are laid out on a logarithmic scale, it is possible to multiply them together by means of the alignment diagram which is shown in the lower portion of the chart. Two such diagrams have to be drawn for H_c and two for M_c. The method of using the diagram, together with an example, is given below.

The pontoon is assumed to be immersed to a depth of 1ft. in each case, and to have a stiff gusset of the dimensions shown in Fig. 4. It should be stated here that if a pontoon is likely to ground other forces will be brought into action, but as grounding will generally take place when the pontoon is partly or wholly out of water, these forces should not be added to

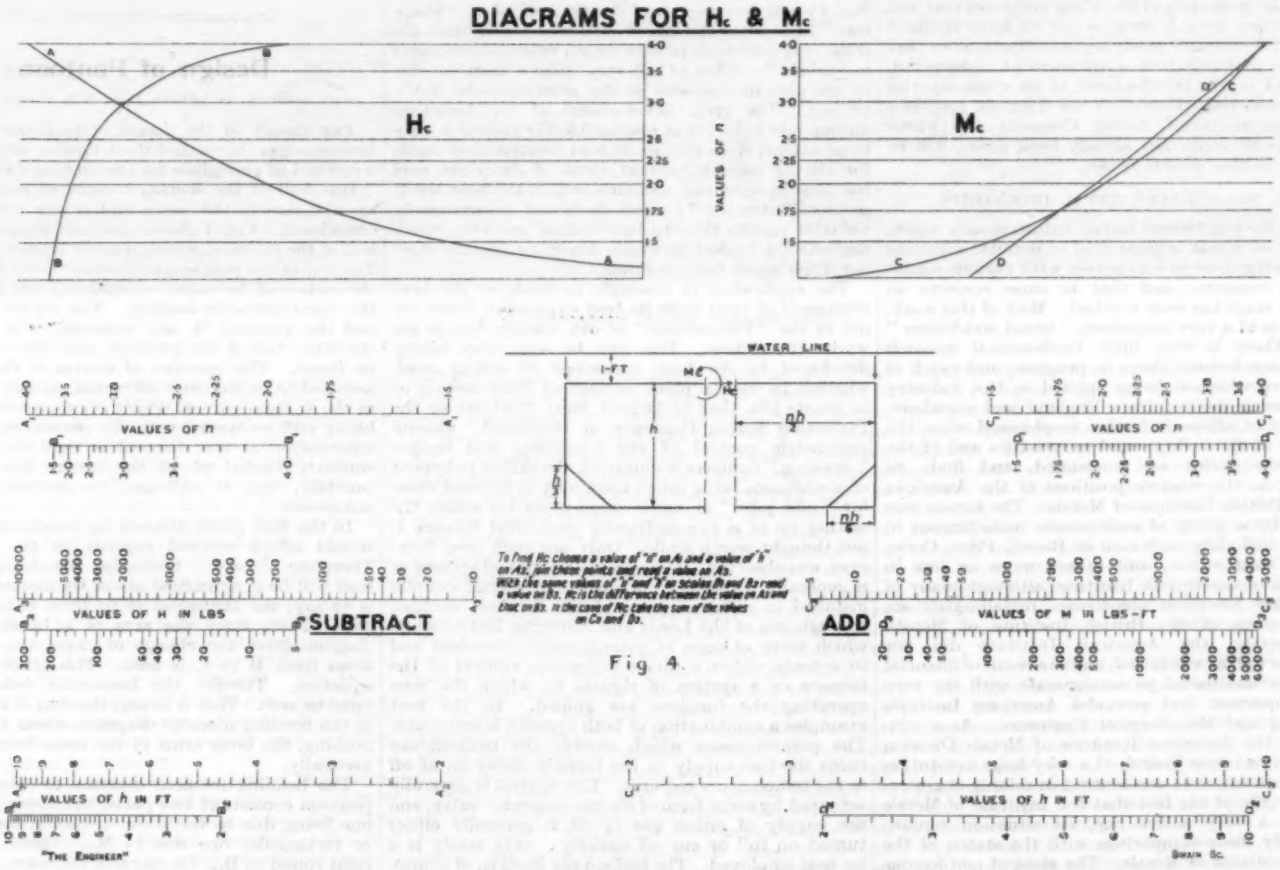


Fig. 4.

those due to water, but should be treated separately, though in much the same manner.

The first step in the design is to decide the number and type of the frames and the thickness of the skin plating. The governing factors are the bending moments due to the water, those due to grounding, and those due to the applied loads on the top of the pontoon. The outline of the design being thus provisionally settled, a fairly close estimate of the weight would, of course, be made to determine whether the pontoon fulfils the requisite conditions as to buoyancy. If it did not do so, its size would have to be altered, the new M_c and H_c being found from the diagram as before.

EXPLANATION AND METHOD OF USING DIAGRAM.

In the diagrammatic section of a pontoon shown in Fig. 4.

h = the height of pontoon in feet,

n = ratio $\frac{\text{width}}{\text{height}}$

Knowing n and h, it is required to find H_c. Enter the chart in the centre at the chosen value of n, and move horizontally until the curve A A is met. From this point descend vertically to the horizontal line A 1, mark the point, and from it draw a straight line to the chosen value of h in scale A 2. This line will intersect scale A 3 at a value which must be noted. In exactly the same way and with the same values of n and h proceed with the curve and lines labelled B, finding a value on scale B 3. The reading on this scale must be subtracted from that found on A 3, the result being H_c.

Values of M_c are found in the same way, except that the two component parts of the result are added and not subtracted.

Example.

$h = 5.5.$
$n = 2.$

First intercept (on A 3)	= 475
Second intercept (on B 3)	= 130
Hence H_c	= 345 lb.
First intercept (on C 3)	= 250
Second intercept (on D 3)	= 490
Hence M_c	= 740 lb. ft.

NOTE.—For purposes of general use, the logarithmic curves A, B, C and D plotted above may be dispensed with by marking the values of n given by them along A_1 B_1 C_1 and D_1.

British Association.

No. II.*

COMPLEX STRESS DISTRIBUTIONS.

THE group of papers presented to the Engineering Section of the British Association by the Committee on Complex Stress Distributions in Engineering Materials brought out a number of interesting facts.

Special attention was given to the report on stresses in bridges by Mr. J. S. Wilson and Professor B. P. Haigh. In recent years the stresses in iron and steel bridge members had, it was pointed out, been investigated in detail, and had been demonstrated by experiment and mathematical analysis to be of a complex nature. The investigations had an important bearing on the choice of maximum or nominal stresses adopted in bridge design. The question of allowable stress and its complement, loading, in relation to railway bridges had during recent years received a great deal of attention in America, India, and this country. In Great Britain and in India elaborate experimental researches were still in progress. These investigations were rendered necessary by the gradual increase in locomotive weights and the necessity of deciding on the renewal of some of the older bridges. The oldest railway bridges in existence were to be found in Great Britain. Many of these bridges had successfully carried all locomotives and trains without restriction for upwards of sixty years, and as the stresses in them had an important bearing on the subject the system followed in their design was of interest. It was important to note that the strength of these early bridges and girders was not estimated in relation to the stresses in them till 1859. Before that time the working strength was always referred to the breaking strength of the girder, which was calculated from the dimensions with the help of a coefficient determined experimentally for the different types of girder section.

The introduction of the stress method revolutionised the system of design, and the distribution of stress had to be considered. The fixing of a stress of 5 tons per square inch as the maximum, without any details as to its application to different parts, led to great uncertainty, but also to further most important investigations. In applying the coefficient method the reduction of area by rivets in the tension flange had been disregarded, as it was also disregarded when determining the coefficients experimentally. The unexpected necessity of measuring the strength of a girder in a new unit with which engineers were not familiar naturally led to inquiries as to how the new standard compared with what had been proved by actual practice to be satisfactory. During a recent period the whole subject had attracted fresh attention. The investigations of the Indian Railway Bridge Committee, carried out for the Government of India, were started in 1917, and were still in progress. The work had been directed principally to the consideration of the "impact" question, and the possible substitution of a new formula for the Pencoyd one which was adopted for Indian railway bridges in 1903. The experimental work in this country had been done by the Ministry of Transport, and an expert committee, which included eminent railway engineers, was about to undertake an extensive programme of experimental work.

A very large number of measurements were already available; 363 were made by the Ministry of Transport and about 3000 by the Indian Railway Bridge Committee, and there was, in addition, a large number of American records. Deflections and strains could be measured accurately enough under stationary and slowly moving loads, but when the movement was rapid, vibrations of the bridge and its parts, combined with the inertia of the instrument, had resulted in many of the records being considered of doubtful accuracy. Evidence of the magnitude of impact factors and the frequency with which maximum impact effects occurred was given by the bridges which had withstood such effects for many years. For instance, if in a girder the measured maximum stress under a stationary locomotive or train was 9 tons per square inch, it was certain that the impact factor could not have been 100 per cent.; it was equally certain that the margin in the strength of the girder had been sufficient to withstand all the impact effects. The measurement of actual static stresses in proved bridges promised a solution of the impact question. Measured stresses could be related to stresses as calculated in the usual way, and nominal working stresses could be adapted to different conditions. A bridge's history and the traffic it had carried was on record, and the strengths and stresses could be determined as accurately as required. The loads carried could also be related to the stresses calculated in the usual simple manner. With that information, by the use of similar calculations and similar nominal stresses, girders with the desired endurance could be designed. That course avoided the numerous difficulties of secondary and intermediate stresses.

It was suggested that the course by which the required knowledge of the ability of many railway bridges to meet modern traffic requirements could be obtained would be by treating existing bridges as full-sized experiments. The other course, which necessitated the establishment of accurate allowances for impact and a standard stress, had, in addition to the impact difficulties, to overcome that of fixing the stress and had to settle details of the method of its application. Some of these difficulties were reflected in the following resolution passed by the Indian Railway Bridge Committee after four years' work:—"After carefully studying the Fereday-Palmer extensometer records of 1500 tests on bridges of spans varying from 15ft. to 358ft. on the North-Western Railway, the Committee are of opinion that, although these tests do not afford sufficient information to warrant their recommending any modification of the Pencoyd formula for impact at present, the records indicate that a single load concentrated at the main driving axle of each engine passing over a bridge more accurately represents the true allowance for impact than a uniformly distributed load. The Committee are also of opinion that many more tests are required before scientific formula covering all sources of impact can be evolved." Except in cases where design was considerably at fault, damage to a bridge was the result of the repeated loading and stressing of its members, and in nearly all cases the first signs were loose rivets and cracks which developed at rivet holes and extended from them.

The report dealt with a number of experiments made with the Haigh alternating stress testing machine.

The experiments were carried out by the authors on model plates 1¼in. wide and $^1/_{16}$in. thickness, 6in. in length. These dimensions were adopted to suit the testing facilities available, and to reproduce the proportions found in a typical full-size plate in a bridge member, 9in. by ¾in., with $^{13}/_{16}$in. holes to suit ¾in. rivets. To simplify the preparation of the test pieces the holes were not plugged.

The results of all these experiments were in agreement with what would be expected from practical experience with steel structures, for the stress concentrations appeared to have little effect. From the general point of view, therefore, with material having a low yield/ultimate ratio as in mild steel, in the case of simple direct stresses the concentrations caused by rivet holes did not greatly affect the endurance of the metal, so that under these conditions, if the real maximum stress could be accurately anticipated, then a standard stress a little below the yield point could be adopted.

Nevertheless, fatigue could occur in perforated mild steel pieces subject to unidirectional stresses; and it was desirable and important to avoid arrangements of rivets that produced undue concentrations of stress. This was particularly true for metals having comparatively high yield points, and even in very mild steel it was desirable that the range of alternating stress should not exceed some definite fraction of the basic fatigue range, no matter what value the steady stress might have. The values of this fraction, it was hoped, might be determined—for different perforations and joints—in the course of further experiments.

The conception of "factor of safety" had to be considerably modified when strength was related to endurance. A maximum stress of 11½ tons per square inch could be endured millions of times, but anything above 12½ might produce fracture in a few thousand repetitions. Assuming the load and impact damaging effects to be at their maximum and repeated uniformly, a member designed on a standard stress of, say, 11½ tons per square inch would do its work for an indefinite period, whereas, if designed on, say, 12¾ tons per square inch, it would not immediately fail, but would deteriorate rapidly. The factor of safety could not be related to these two stresses or to the number of repetitions necessary to produce failure in each case.

Considering two such comparative designs with respect to normal traffic conditions, the occurrence of the maximum impact effect, depending on the worst engine and train combination travelling at a critical speed, might be so infrequent that the 12¾ stress design would show no more signs of deterioration than the other, and both would have a substantial margin.

STRESSES IN ROUND BARS.

The report included a paper by Professor W. Mason on "The Distribution of Stress in Round Bars under Alternating Torsion or Bending." The object of the author was to find a relation between stresses in hollow and solid specimens. The report pointed out that alternating torsion or bending of round bars leads to a condition in which the range of strain, at a given range of torque or bending, increases to a stationary value provided that such given range is less than the fatigue range and greater than the primitive elastic limit range. For mild steel in this stationary condition of strain the following assumptions are made concerning the distribution of strain and stress throughout the body of the specimen at instants of maximum strain of the cycle:—(1) A distribution of strain linear from axis to skin; (2) (*a*) a distribution of stress conforming to Hooke's law, *i.e.*, of perfect elasticity, from the axis for a portion of the radius; (*b*) for the remainder of the radius, a relation between stress and strain similar to the linear relation found experimentally between the ranges of strain and stress in thin-walled tubular specimens in alternating torsion. Applying these assumptions, it is found that the results of certain alternating tests of solid specimens in torsion become practically identical with those of hollow specimens, and that the results of the author's alternating tests of hollow and solid specimens in bending—bending always about the same axis—are in fair agreement. The author concludes that the difference between (*a*) fatigue stresses calculated from the range of torque or bending moment on the usual assumption of linearity of stress, and (*b*) the actual fatigue stresses, must be greater than is commonly supposed for solid specimens, and also for hollow specimens in alternating bending.

STRESSES IN PIPES.

The design of the pipe line in large hydro-electric installations working under high heads presents considerable difficulties. These are dealt with in a paper by Professor Gilbert Cook. For a given discharge and head at the power station, considerable economy in material can be effected by increasing the size and reducing the number of the pipes. In the plain welded pipe a limit of size is imposed by the maximum thickness which can be welded satisfactorily, and recourse has been had to a system of reinforcement by means of steel rings shrunk on at intervals. Interest arises as to the method by which the strength of these pipes may be estimated. The investigation which is dealt with in the paper has several points of interest, among them the question as to the conditions under which a reinforced pipe can be made lighter than a plain pipe. Some unexpected conclusions have been reached regarding the relation between the spacing of the ring reinforcement and its effectiveness. The author has investigated the stresses in the case of a reinforced pipe in the pipe line of the Los Angeles power station. The internal diameter of the pipe is 80in., and the thickness 0.63in. The reinforcing rings are 4.45in. wide by 1.575in. thick, and are spaced 11.05in. centre to centre, leaving an unsupported length of pipe equal to 6.60in. The working pressure is given as 278 lb. per square inch. It is shown that the possibility of allowing a higher working stress in the rings than would be safe for the pipe, enables a reinforced pipe to be made lighter than a plain pipe, provided that the rings are sufficiently close together. Details are given of a calculation on the Los Angeles pipe assuming a stress of 10 tons per square inch for the rings and 6 tons for the pipe, which shows that the spacing of the rings must be less than 12in. clear to obtain a lighter pipe.

CONNECTING-RODS.

Forked connecting-rods formed the subject of a contribution by Mr. William J. Kearton. The

* No. I. appeared September 21st.

author said that the forces brought to bear on many engine parts were very complex, and to obtain an approximate idea of the value of these stresses various assumptions had to be made. These assumptions often vitiated the calculated results, and might even make them valueless except as a means of comparing the strength of parts to be constructed with that of parts which had withstood the test of experience. The forked end of engine connecting-rods was a case in point. Forked connecting-rods were of two types; one in which the gudgeon pin was pressed or shrunk into the forks and formed an important connecting link between the two limbs, and the other type in which the fork had palms which supported brasses embracing the halves of a gudgeon pin forged integrally with the crosshead. Whilst the first type was undoubtedly stronger, the second type was probably superior from other considerations, and was more extensively employed. The magnitude of the stress on any section of the fork showed a variation of from 5000 lb. to 7000 lb. per square inch, but Bauer in his "Marine Engines" had stated that in both large and small marine engines a stress of 14,000 lb. per square inch had been used successfully in practice. It might be further stated that in a certain naval engine the stress in the fork of the connecting-rod was no less than 18,500 lb. per square inch. When it was remembered that the stress was a fairly rapidly alternating stress, it was hard to believe that the calculated value even approximated to the truth.

Dealing with the allowable alternating stresses which might be adopted, the author said experiment showed that for ductile steels which would be used in the forging of connecting-rods, the reversal limit was about one-third and the repetition limit about one-half of the ultimate strength of the material. Allowing a factor of safety of 3 and assuming that the ultimate strength of the mild steel used was 70,000 lb. per square inch, the following results were obtained. Safe reversal limit, 7780 lb. per square inch; and safe repetition limit, 11,670 lb. per square inch. In a steam engine there was a complete reversal of stress once every revolution. In a two-cycle single-acting Diesel engine there was a repetition of stress every revolution, but owing to the presence of inertia forces the stress never reached zero. In a four-cycle Diesel engine there was, during the working stroke, a change from a maximum compressive to a relatively small compressive stress followed by relatively insignificant complete reversals during the exhaust and suction strokes and then during the compression stroke a change from a small compressive stress to a maximum compressive stress. It appeared, therefore, that so far as the influence of alternating stress was concerned a single-acting Diesel engine connecting-rod was not so severely stressed as that of a steam engine. It should be stated that no researches had been made on the repetition of compressive stresses. The main object of his work was, said the author, to arrive at a more accurate method of calculating the stresses and to give experimental evidence on the subject.

He had calculated the stresses in a forked connecting-rod in which the gudgeon pin was integral with the fork. The rod was that of a small marine engine intended for a destroyer, and the following table gave a comparison of the calculated measured stresses:—

Sect. No.	Calculated stress.		Space average of stress for space symmetrically disposed with respect to the given section.			
			Calculated.		Measured.	
	Intra-dos.	Extra-dos.	Intra-dos.	Extra-dos.	Intra-dos.	Extra-dos.
9	−4486	+1594	—	+1275	—	+1145
10	−4265	+1215	−4010	+1150	−4315	+1005
11	−3885	+ 795	−3750	+ 765	−3925	+ 910
12	−3520	+ 380	−3520	+ 380	−3360	+ 137

The rod was subjected to a compressive load on a Buckton testing machine, and measures were taken to apply a uniformily distributed load. The author expressed the belief that his result went far to explain the apparent anomaly that an overstressed material could be used year in and year out without a sign of failure.

Graphical Determination and Fatigue.

Professor L. N. C. Filon dealt with "The Use of Photo-elastic Observations for the Graphical Determination of Stress."

His paper shows that observation of the colours of polarised light passing through a plate of transparent material strained in its own plane leads to a knowledge of the difference P-Q of the principal stresses. The author develops a graphical method whereby both stresses P and Q are found from the optical data without having recourse to a strain measurement of lateral contraction.

Professor B. P. Haigh discussed the application of thermo-dynamic principles to the physical change that occurs in a ductile metal suffering fatigue. Hysteresis and fatigue are attributed to a dual action, of decrystallisation and recrystallisation, associated with conduction of heat and, therefore, thermo-dynamically irreversible. Experimental results are given to show how this hysteretic action varies in three stages during the course of fatigue tests.

Professor F. C. Lea said that the report on complex stress distributions in engineering materials was the most important subject which the Engineering Section had been called upon to discuss. With regard to the report by Mr. J. S. Wilson and Professor Haigh dealing with stresses in bridges, there was one point to which he desired to take exception. It was stated on page 31 of the paper that it had been established that the resistance of steel and iron to fatigue by simple tensile and compressive stresses was dependent on the ratio of its yield strength to its ultimate strength and to the relation of the maximum and minimum stresses impressed on it. He would like to know upon what basis such a generalisation had been made, as experiments seemed to show that it was not quite true, particularly of alloy steel. It was necessary to be very careful that there was sound reason behind a statement of that character. He would also like to ask Mr. Wilson a question on the subject of repetition stresses. In the case of a bridge the maximum stress occurred only infrequently, and it would, perhaps, take a year to get a million repetitions. Was it suggested that the same conditions applied to a bridge as in a machine running at 2000 revolutions per minute where the maximum range of repetition stresses took place very rapidly. He thought that some confusion of ideas had arisen generally in connection with stresses on bridges, and it was necessary to determine experimentally what the actual stresses were, although that did not mean for one moment that the elastic theory must be discarded in calculating bridge stresses in the first place. The actual stresses in particular structures loaded in a particular manner must be related to the stresses which the elastic theory would indicate to exist.

Professor R. L. Sackett referred to a bridge of the plate girder type with which he had been familiar at Detroit which had withstood traffic conditions since about 1860, although in that period there had been an enormous increase in the loads and speed of traffic. He also had in mind early wooden bridges which had carried the traffic on main highways for a period of about sixty years. A good deal of work in connection with bridge stresses was being done through the American Society of Civil Engineers. Professor Talbot had devoted much study to the subject, and particularly to the effect of varying loads and varying speeds. Important lessons had been learned from the failure of the Quebec bridge.

Sir James Henderson said that the reports on complex stresses formed a valuable contribution to a new science which was still in what Lord Kelvin would have called the natural history stage. More experiments were necessary to establish a sound theory. When the theory came it would explain many things which were included in the property of cohesion, which had been the subject of a joint discussion in the Mathematical and Chemical Sections of the Association. Engineers were not yet certain whether the fundamental assumptions made in connection with the stresses on engineering structures were fully justified.

Professor W. Mason referred to the effect of superimposed periods of vibration and the effect of coincidence. He emphasised that fact because that particular kind of stress, which was a very material factor in the impact stresses, appeared to have been left out of consideration.

Sir Henry Fowler expressed satisfaction that the Engineering Section had taken up the subject of railway bridges and traffic stresses, and he hoped that useful information would be derived from the investigation which was about to be made. As a locomotive engineer he had, on various occasions, been restricted by the types of bridges over which locomotives had to run. In his experience the restricting factor on British railways was the small bridge of from 15 to 30 tons.

Mr. Wilson, in closing the discussion, referred to one or two points raised by Professor Lea. No other material than mild steel had, he said, been taken into consideration, as they had found the problem sufficiently difficult without complicating it by the introduction of other materials. With regard to the point raised by Professor Mason, he agreed that synchronisation of vibration ought to be taken into account in arriving at a figure for maximum stresses.

Electric Propulsion of Ships.

Recent developments in the employment of electrical transmission on ships were described by Mr. F. H. Clough.

He said that the efficiency of electric transmission was about the same as that of double reduction gearing. Mr. W. J. Belsey, before the Institute of Engineers and Shipbuilders in Scotland, had worked out some examples in which he showed that the losses on turbo-electric equipment were 8.2 per cent., on double reduction gearing 10 per cent., and on single reduction gearing 8 per cent. Apart from the efficiency point of view there were advantages in the electrical equipment which could not be obtained with the gearing. In general, a single turbine could be used instead of two, which saved a considerable amount of loss in the glands, piping, &c. Much higher superheat could be used than with the geared turbine, which, on account of the reversing blades, was limited in that respect, and the loss associated with the reversing blading was eliminated. Apart from the bearings which, of course, could be oil film lubricated, there were no wearing parts in the electrical equipment, and provided the equipment was properly designed, it should have an almost indefinite life. Should repairs be necessary they could readily be carried out, and generally a repair would consist in replacing some of the electrical conductors on which the insulation might have become damaged. That was comparatively a simple matter and could be carried out in most cases in port.

Although the Diesel engine ran at approximately the same speed as the propeller, electric transmission could be usefully employed, even on Diesel ships. The advantages were that the engines could be subdivided into smaller units and could probably be run at higher speeds. The engines could also be started up light and once started could be left running even when the ship was standing still. Reversing could be done by the electrical equipment without reversing the engines. Alternating current was generally used for ship propulsion, but direct current could be, and was, employed for small installations. The advantage of this system was that the ratio of speeds between generator and motor was variable. The difficulty was that the current had to be reversed by means of carbon brushes on the commutator, which was only practicable with currents of moderate amount. Nor was it possible, owing to the commutator being exposed, to use very high voltages.

A very successful example of an alternating-current ship was the San Benito, which belonged to the United Fruit Company. This ship was built about two years ago by Messrs. Workman, Clark and Co. and equipped by the B.T.H. Company, and had been running between Boston and the West Indies very successfully. In the case of the ships being built by Messrs. Cammell Laird and the B.T.H. for the United Fruit Company a large amount of power was required for the refrigerating plant in addition to that for propelling the ship. In that case the Diesel engines were fitted with two sets of generators, one being used for propelling and the other for supplying power to the freezing plant. By using direct-current machinery the engines could run at full speed, whatever speed the ship was running at, and therefore full power was always available for the freezing plant.

Glare in Industrial Lighting.

Dr. G. H. Miles presented a paper dealing with glare in the lighting of workshops. He said that for some time past increasing attention had been given to the importance of lighting in industry, and a number of very interesting experiments had been carried out by large industrial concerns. These had proved the importance, from a commercial point of view, of increasing the amount of light in industrial plant. In one large firm the following three years' test of the lighting was carried out, and careful records taken in order to compare the efficiency of the lighting as gauged in terms of output. When the experiment began the intensity of light was 1.2 foot-candles, and the factory was lighted by lamps suspended from drop cords. The first change was to replace them by 100-watt lamps with overhead reflectors, giving 6½ foot-candles intensity. With this alteration an increase of 13 per cent. in production was obtained. This improvement encouraged a still further increase, and 150-watt lamps were put in, giving 9 foot-candles. This step led to an increase in production of 17.9 per cent. Finally, 200-watt lamps with overhead reflectors were installed, giving 14 foot-candles, and the result was an increase of 25.8 per cent. production over the original installation. The increase from 1.2 to 14 foot-candles represented a very big step in intensity, but the increase in production was sufficient to warrant similar alteration being carried out in other factories. The general tendency of to-day was to increase illumination. The manufacturers of lighting equipment were alive to the importance of lighting, and were bringing out lights of greater intensity. It was, indeed, a matter of common observation that the number of brilliant gas-filled lights was rapidly increasing. Though increased illumination in itself was doubtless a good thing, yet where this increase was obtained by replacing the smaller low-powered lights by fewer high-powered lights, and the illumination of the room was concentrated in a few high-powered centres, the possibility of glare was greatly increased.

The Departmental Committee on Lighting in Factories and Workshops defined glare as the effect of looking directly at a bright source of light, such as an arc lamp, so that the worker was for the time being prevented from seeing other objects properly. The effects of such glare were so obvious that in the majority of cases the worker was able to take steps to prevent its results. In a comparatively short time, however, the unpleasant immediate effects disappeared, and a person was apparently free from the effect; but careful observation showed that although not directly conscious of any blinding, there was left behind, for some considerable time, a visual area in which the vision was distinctly impaired; though the person might not be aware of the

defect. There was present in the eye a blind spot similar to the actual blind spot, though it was no more realised than was the presence of the blind spot itself.

In addition to the presence of this temporary blind spot, there were other after effects due to the influence of the central stimulation which gave rise to distraction under certain conditions. If, for instance, there was a rapid change in the intensity of light entering the eye caused either by a shadow passing over the surface at which one was looking, by a temporary blinking of the eyes or by a temporary increase in intensity of illumination of the surface looked at, a distinct image of the original glare of light would be produced. The results of experiments showed that the after effect of the light stimulus had a considerable influence upon the accuracy of work. In some subjects as much as 25 per cent. increase in error was noticed.

The points which he wished to emphasise were (1) that the use of high-powered sources of light, especially when of small area, such as an unshaded filament or too small a frosted globe, increased liability to accident through direct temporary blinding or by the even more dangerous formation of unrecognised blind spots, and (2) that unless well distributed, lighting of this character gave rise to too big a difference between the source of illumination and the average intensity of the light reflected from surroundings, causing liability to the formation of projected images which produced unnecessary irritation and distraction and impaired accuracy of work.

Wireless Telegraphy and Shipping.

Recent developments in the application of wireless telegraphy to shipping formed the subject of a contribution by Commander J. A. Slee.

High-speed transmission had, he said, become necessary for the heavy traffic handled by Transatlantic liners, and by the newest devices receiving speeds up to 100 words per minute could be obtained. The receiving apparatus consisted of the usual loose-coupled circuits tuned to the frequency of the wave it was desired to read, the high-frequency current being amplified by six high-frequency valves working in a transformer coupled amplifier of the well-known "55" type. The rapid increase in the number of wireless stations had made reading of messages in ships at sea very difficult. Two or more messages might be audible in the telephones at the same time, and it was exceedingly difficult to pick out the particular sounds which it was required to detect. To remedy this defect two-stage note filters had been introduced, but they were only suitable for reading continuous wave messages in which the pitch of the note received could be varied at will and adjusted so that the desired signal was received at the beat note corresponding to the selective frequency of the filter. Filters were of no practical service for spark telegraphy.

The use of the wireless beam, which was a signal on an exceedingly short wave length in the form of a concentrated beam, had proved a great step in the adaptation of wireless telegraphy for purposes of navigation. The great advantage was that this abnormal form of telegraphy was entirely free from interference from other signals, and the special receivers devised for this exceedingly short wave telegraphy could be used by navigating officers. Only one such station at present existed—that at Inchkeith Island—but a second was being erected near the South Foreland lighthouse. The process was still in its infancy, but it was believed that its use would extend rapidly in the near future. At present the range at which bearings could be obtained with accuracy was about 10 miles. A steady improvement was being effected in the accuracy of long-range direction finders. Their present range was nominally 100 miles, which was about the greatest distance at which the system was of real value to navigation. Causes of error of direction finding were now being investigated, but it was a complicated undertaking. The present research was intended to add to the knowledge possessed as to the causes of error, and the number of stations about which it was possible to lay down definitely the arcs of good and bad bearings. Advances were also being made in the use of wireless telephony, and experiments were in hand with the object of linking up vessels within a moderate distance of their terminal port with the local post office system. The real complexity of the problem arose when the land telephone station had to be operated by subscribers at greatly varying distances from the exchange, but experiments were now in progress which it was hoped would overcome the trouble.

Professor G. W. O. Howe commented on the return, in the wireless beam device, to the early experiments of Hertz, who used short wave lengths and tried to reflect the waves by the use of parabolic reflectors. When his experiments became the basis of wireless telegraph developments, recourse was made to longer wave lengths, and the return to earlier methods was being watched with great interest. The time was coming very quickly when in narrow waterways ships would be navigated with perfect confidence in the densest fog.

Professor E. W. Marchant expressed interest in the use of beat reception, one of the advantages of which was the elimination of atmospheric disturbance. He had been making experiments with the reception of long wave signals, and the improvement obtained by the use of beat reception was very striking indeed. With regard to the short wave receivers, he did not think that Commander Slee had laid sufficient emphasis on the fact that such receivers were unaffected by fog. It had been found by experience that the range of short wave receivers could be extended to about 20 miles by placing the receivers on an eminence, whereas the range on the ground was only 4 miles. In connection with direction finding apparatus, he assumed that the experiments had been conducted on the ordinary 600 m. wave lengths which, perhaps, accounted for some of the effects observed.

Commander Slee, in reply, said that the erection of additional stations to enable ships to take bearings in areas not at present well served off the British coast was now under consideration. The work of establishing these sub-stations had, however, been hampered by some difficulties. The stations must be practically unwatched, and the most suitable location from the navigational point of view would be lightships or lighthouses, where, when the weather conditions made it necessary, they could be put in operation by the attendant. The wave length employed would be 450 m. In the United States four stations of this type were in operation in the approaches to New York. They were known as radio-fog signal stations, and the method of operation was slightly different from that proposed for British waters. With regard to the mode of operation the present idea of British authorities was to transmit signals for 1 min., followed by a 4 min. silent interval. The wireless beam system, he was quite aware, had the advantage of non-interference from atmospheric conditions, and there was no reason why navigators should not work the apparatus themselves. With regard to wave length for direction finding, the practical limits were between 400 m. and 1000 m. As far as experience went, weather conditions had no effect whatever upon the working of direction finding apparatus if it had been accurately fitted.

Conservation and Control of Water Resources.

In a contribution in which he emphasised the need of a careful consideration of the whole subject of water resources and their control, Mr. Joseph Parry said that every new session of Parliament brought evidence of its increasing urgency. Most of the best upland sources, those with heavy rainfalls, favourable geological conditions, and at elevations suitable for distribution by gravity, had already been appropriated by the big towns. The statutory powers obtained by these municipal authorities and private companies included possession of considerable areas over which a monopoly had been secured with a view to possible future extensions. These surplus areas were for the most part greatly in excess of the actual present requirements of their owners, and might in fact never be fully utilised. Meanwhile, there were many districts badly in want of water and new demands for both industrial and agricultural purposes were springing up all over the country.

Of late years numerous claims had been set up and authority had been given for utilising upland streams to generate electrical energy for industrial works. These power producers were formidable competitors for the sources that were most suitable for water supply purposes. Hence another strong reason for prompt action to lay down principles upon which conflicting claims should be dealt with. To carry out a complete survey was undoubtedly a big task. It should include engineering facts as to areas and levels, geological facts as to suitability of sites for reservoirs, rainfall returns, chemical and medical reports on quality, particulars of population affected and character of soil in the several areas, actual yield and use of any areas already appropriated, and suitability of direct river supplies at low levels by pumping. Much of the desired information was already in the possession of Government Departments in the form of information on the resources of water-yielding rocks collected by the Geological Branch of the Ordnance Department. The completion and tabulation of the survey should be pushed on without further loss of time. The determination of a national policy to be adopted and of the new legislative provisions required need not be postponed until the whole of these facts had been recorded. To obtain a comprehensive foundation for such a policy a Royal Commission would be the best preparation. For the ascertainment of facts a Government Department might suffice, but for laying down principles on which legislation affecting the whole country was to be founded a higher authority was required. Such a Royal Commission, with its public sittings, would attract the attention of the country and would elicit the views of public authorities and professional men interested, thus providing an adequate foundation for recommendations to Parliament.

At the opening of the line between Saint-Die and Provencheres, constituting the first section of the scheme for tunnelling through the Vosges, it was announced that M. Le Trocquer, the French Minister of Communications, would shortly invite tenders for the tunnel on the Saint-Die-Saales section.

The Shipping, Engineering and Machinery Exhibition.

No. V.*

The Ailsa Craig Motor Company, of Strand-on-the-Green, Chiswick, London, showed a launch and standard work boat, both of which were fitted with the Ailsa Craig type of marine motor. The four-cylinder, 10 to 14 brake horse-power model was described in The Engineer of August 11th last year, and since that time progress has been made both in the types of motor manufactured and the output of engines. The present sizes manufactured by the firm comprise the Kid Junior, 6 to 8 horse-power; the Kid, 10 to 14 horse-power; while a new size, developing 20–24 horse-power in the four-cylinder model and 28–36 horse-power in the six-cylinder engine, has recently been added. These larger engines are also made with a reducing gear combined with the reversing gear, so that they can be used for heavy craft requiring a slow-running propeller. Overhead valves directly operated and offset cylinders are retained for all types of engines, as are also the plunger type circulating water pump and the one-piece multiple plate clutch and reversing gear which forms one unit with the bed-plate. A new feature is the neat arrangement of levers for the clutch control and brake gear, which for the larger engines supersedes the wedge control still used on the small engines.

Charles Burrell and Sons, Limited, of Thetford, had a stand at the exhibition, and one might expect from the name to find it occupied with traction engines.

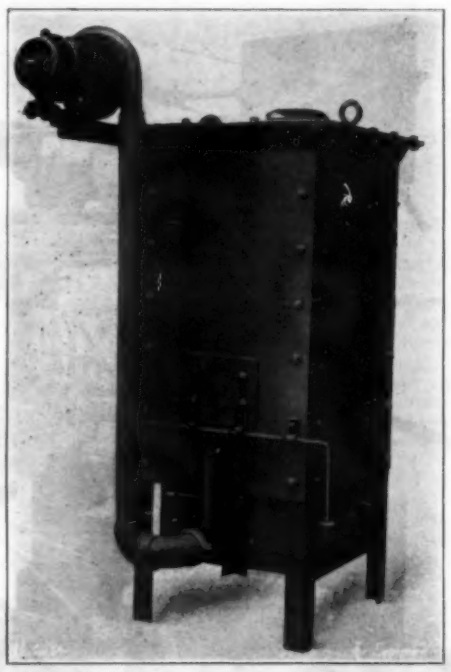


FIG. 54—MUFFLE RIVET-HEATING FURNACE

It was, however, devoted to a new type of rivet heating furnace, which we illustrate in Fig. 54. As will be gathered from the engraving, which represents the back of the furnace, it is of the muffle type, in which the rivets are not subjected directly to the heat of the fire. As a matter of fact, there are three separate compartments in the casing. The bottom one is the fireplace; above this there is the heating chamber, into which the products of combustion are conducted by side flues, while at the top there is a pre-heating chamber. The floor of the pre-heater is made of perforated bricks through which the hot gases ascend, and at the back there is an opening communicating with the main heating chamber below. The rivets are put in the top compartment and pushed down this opening as they warm up. They are then drawn to the front again and handed out to the riveting gang. In the first stage the temperature is raised to some 750 deg. Cent., while the rivets are finished at from 1000 deg. to 1100 deg. Cent., and one of the most valuable features of the apparatus is the facility with which the final temperature can be regulated and maintained. On reference to the illustration it will be noticed that an electrically driven fan is used to provide the necessary draught. The blast-pipe is divided so that some of the air is supplied below the grate and the remainder into the combustion space. Both the branches are fitted with dampers, and the ash-pit is flooded with water. A good deep fire is maintained, and the apparatus is virtually a miniature gas producer that will burn almost any kind of coal, cinder or slack. Provision is, of course, made for getting at the fire-bars and for clearing the ash-pit. The furnace stands about 5ft. high by 2ft.

* No. IV. appeared September 21st.

square and weighs a ton. The fan motor is of ½ horse-power. As to output, the makers tell us that two hundred 3in. by ⅞in. rivets, or six hundred 2in. by ⅝in. rivets can be heated per hour.

We have, on several previous occasions, referred to the oxygen jet cutting machine made by the Godfrey Engineering Company, of Boundary-lane, London, N. 22, but the machine shown at the exhibition, which we illustrate in Fig. 55, includes several distinct improvements, including a very substantial table for carrying the work. By the way, we notice that the Godfrey Company has just secured patent rights for an elaboration of the machine which embodies a work table travelling on rails.

In these machines the blow-pipe, which is used for cutting, is attached to a swinging jointed arm, made of two aluminium castings, hinged to the main frame. This frame carries at the top the friction disc gear-boxes, that on the left of the illustration being driven off the line shafting or, if more convenient, by a small electric motor which need not be of more than ¼ horse-power. This main disc drives a small disc attached to a shaft which transmits motion to a second friction disc on the right, and from thence the motion is conveyed by means of flexible shafts to the compound slides and rotating table. Knock-off motions are provided on the cross slides to allow for quick and easy manipulation in setting work, &c. As all the motions are derived from the main friction disc, their speeds are all controlled by one lever—seen on the left—which moves the small driven disc in and out from the periphery of the main disc.

No extra attachment is required for circular and straight cuts. For circular cuts the rotary head is used. This head is attached to the lower slide, and consists of a worm drive actuated by a flexible shaft. A graduated radius bar, in one end of which the blow-pipe spindle engages, is driven by the worm wheel. The blow-pipe is thus maintained at a fixed distance from the centre of the worm wheel, this distance being the radius of the circle cut.

For straight cutting the longitudinal and transverse motions of the slides are used, whilst it is extremely easy to cut square and rectangular holes by means of the stops on the slides. These stops can be so set that the motion of one slide is automatically cut out and that of the other slide brought into use.

A noteworthy feature of the machine is the template following attachment, by means of which irregular shapes can be cut. The template, of thin wood or metal, is attached to a spindle which passes through the centre of the rotary head and is rigidly fixed. Attached to the end of the graduated radius bar is a second bar or lever, the end of which, with the blow-pipe attached, is kept pressed against the template by a spring, the shape of which is, of course, duplicated in the work piece.

Another template is used when the work is of an elongated shape. The template in this case is attached to the end of the longitudinal slide. A spring-loaded lever attached to the rotary head which, in this case, can only be moved along the longitudinal slide, keeps the blow-pipe pressed against the template. A third method of employiug a template is by means of a spindle in the centre of the rotating table. The template and the piece to be cut are both attached to this spindle, the template being uppermost. In this case the centre joint in the aluminium arm is locked, and the blow-pipe is spring-pressed against the template. The table is rotated, carrying spindle, template and work piece around, and the fixed blow-pipe naturally follows the contour of the template.

The table, as we have already hinted, is of very substantial construction, and will carry 8 tons. All the operating levers, start, stop, reverse and elevating hand wheel, are conveniently placed within the operator's reach. The table can be moved to any position relatively to the machine, so that large pieces of work can be accommodated.

A refinement in the blow-pipe arrangement is the provision of a joint for tilting, by means ot which any angle up to 45 deg. can be cut. This is, of course, useful when it is desired to cut a plate with a caulking angle.

A neat little electric lighting plant, exhibited by Stuart Turner, Limited, of Henley-on-Thames, is shown in Fig. 56. In designing this plant simplicity and reliability have been the objects chiefly in view. The plant is as nearly fool-proof as possible, but it is not of the automatic type; that is to say, it cannot be started by switching on the lights. The engine is of the two-stroke, three-port type, with no valves or valve gear to get out of order. The engine has a bore of 2½in., and a stroke of 2½in., and is capable of generating 1 brake horse-power. The crank shaft is fitted with roller and ball bearings, and the connecting-rod is a steel drop forging with plain bronze bearings. The piston is of cast iron with three rings, and the carburetter and governor are combined, the latter being adjustable while the engine is working.

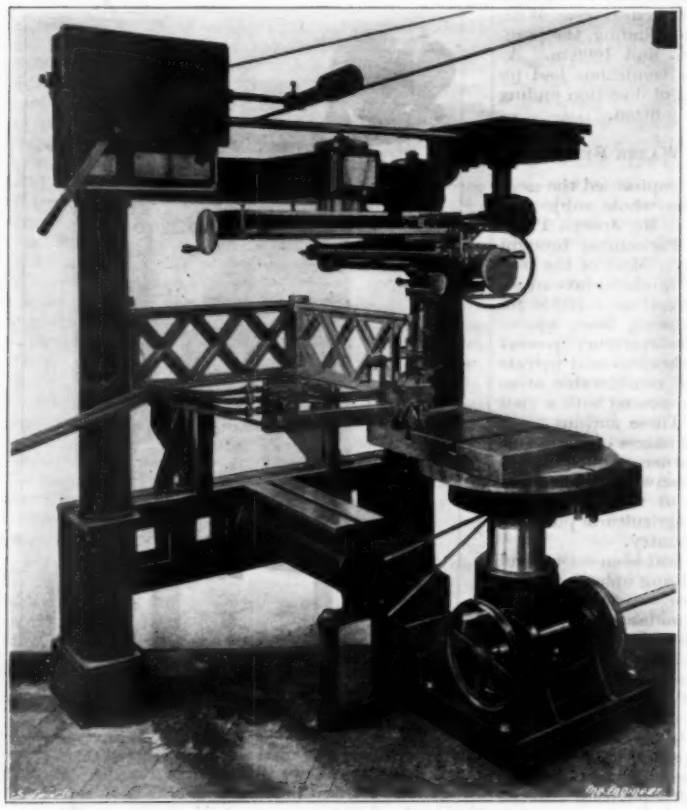


FIG. 55—GODFREY OXY-ACETYLENE CUTTING MACHINE

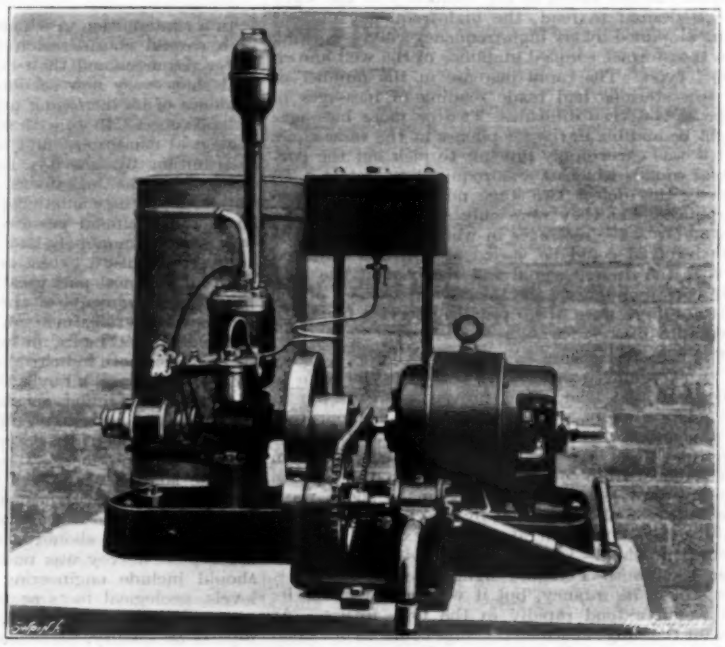


FIG. 56—STUART TURNER ELECTRIC LIGHTING SET

The engine is fitted with a magneto in line with the crank shaft, from which it is driven by a flexible coupling. The lubrication is on the "Petroil" system, and requires little or no attention. The dynamo is specially wound to act as a motor for starting the engine, and its speed is 1200 revolutions per minute, the charging rate being 14 ampères. The dynamo is direct-coupled to the engine. The switchboard is an enamelled slate panel and is provided with two ammeters, a volt meter, fuses switches, shunt regulator and automatic cut-in and cut-out, which automatically connects the dynamo to the battery on starting and disconnects when the engine stops. A feature of this little plant is the ease with which a pump can be driven by the engine for supplying water. The pump is driven by a chain and clutch mechanism, so that it can be thrown in and out of operation as required irrespective of the dynamo. The whole set forms a useful little plant for country house purposes.

United Water Softeners, Limited, Imperial House, Kingsway, W.C. 2, had an exhibit showing its methods of water purification. It comprised a full-size Lassen-Hjort water softening installation and a complete Permutit softening installation. The former was reducing the hardness of the London water to 2 deg., while the Permutit plant was producing water of zero hardness. Permutit plants of various sizes down to one small enough for fitting over a hand-basin were shown. The same firm exhibited the Wallace-Tiernon automatic chlorinator, for adding chlorine gas in minutely measured and absolutely controlled quantities to water supplies for sewage effluents, &c. There are two types of this apparatus, one by which the chlorine is introduced directly into the water or sewage, and the other by which the chlorine is first dissolved in a small quantity of water and the resulting solution piped to the point of application.

Variable Speed Gears, Limited, Broadway-court, Westminster, S.W. 1, had a very attractive stand on which the firm exhibited a range of Williams-Janney hydraulic variable speed gears and variable delivery pumps in sizes from 2 to 200 horse-power. In connection with this exhibit it is interesting to note that the Admiralty has recently decided to instal this type of gear for operating windlasses, boat hoist and steering gears in the two battleships now under construction. Although the Williams-Janney system is already familiar to most of our readers, it may not be out of place to state again that the electrical outfit is of the simplest kind, comprising only a driving motor and a light load starter in each case, while horse-power and torque overloads are guarded against by hydraulic automatic control provided with the gears. On the stand was to be seen in operation a specimen of the company's electro-hydraulic steering gear, a small set of variable speed gear driven by an electric motor in operation, and a typical pumping set fitted complete with automatic control and capable of delivering fluid up to 2¼ tons per square inch. Pumps of this description are now in use for operating baling presses, hydraulic riveters, &c., without the use of hydraulic accumulators. The advantage claimed for this type of pump is that it delivers fluid at a low pressure when taking up the idle travel of the press ram, whereas in an accumulator installation the whole of the fluid has, initially, to be pumped at the maximum pressure.

Babcock and Wilcox, Farringdon-street, E.C. 4, showed a large number of appliances, including a mechanical chain-grate stoker of the compartment type in operation. This stoker embodies the latest developments, permitting of the regulation of the air supply to any portion of the grate, thus ensuring complete combustion of low-grade fuels. The stoker is fitted with a new design of driving and change-speed gearing. There were also shown on this stand a number of models of special interest to engineers and those interested in labour-saving appliances for the economical handling of materials. A marine type boiler arranged for either coal or oil firing has all parts submitted to pressure constructed of forged steel. The tubes are all straight and all the joints are expanded, all parts being easily accessible for cleaning and repair. The marine type of boiler can be fitted with a superposed economiser. The chain-grate stoker is enclosed in a wrought steel casing and forms a self-contained steam-raising unit of high efficiency. Boilers of this type have been supplied in units evaporating from 100,000 lb. to 120,000 lb. of water per hour. A model of a land type water-tube boiler with superheater and chain-grate stoker was also shown, together with oil burners, in which either steam or air is used as a spraying or atomising agent and in which the air is atomised mechanically by pressure. The lever-balanced luffing jib crane shown automatically moves the load horizontally, maintains the jib in a state of balance and combines high speed with safety in luffing operations. The gear is applicable to any kind of jib crane driven by any source of motive power. Its application to shear legs was shown by a model.

Another model shown was that of a self-dumping single-chain grab suitable for handling various kinds of material such as coal, ballast, grain, &c. It can also be used for digging or dredging clay, sand or mud. Some power-driven tube cleaners suitable for removing incrustation from straight or curved tubes by means of water, steam or compressed air were also features of this firm's exhibits.

The Metropolitan-Vickers Electrical Company, Limited, of Trafford Park, had a Viking ship's winch on the stand of Messrs. Harfield and Co., Blaydon-on-Tyne, which is illustrated by Fig. 57. This electric winch has been designed as nearly as possible to occupy the same space as an ordinary steam winch

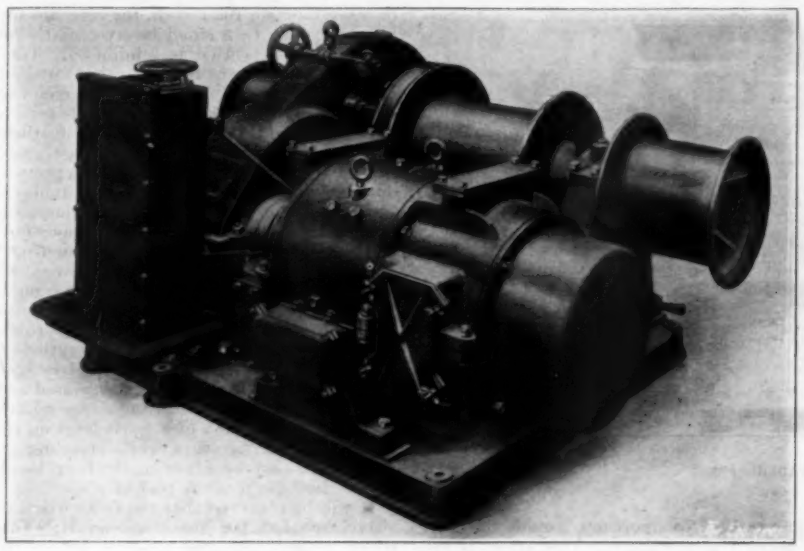


FIG. 57—METROPOLITAN-VICKERS ELECTRIC SHIPS' WINCH

and to be operated in much the same manner. The motor, gearing and controller are all made water-tight and will withstand being washed by heavy seas. The machine is made in two types; one with spur gear, as illustrated, and the other with worm gearing, while they can both be operated either by a drum controller or a contactor gear, as shown in Fig. 58. With the drum controller two sets of gearing are provided to give a high speed for light loads, but with the contactor gear acceleration is effected by a special relay which is independent of the operator. The winch has a central barrel and two warping drums fitted on the main shaft, which is supported by a gear case and side stand. The centre barrel and warping

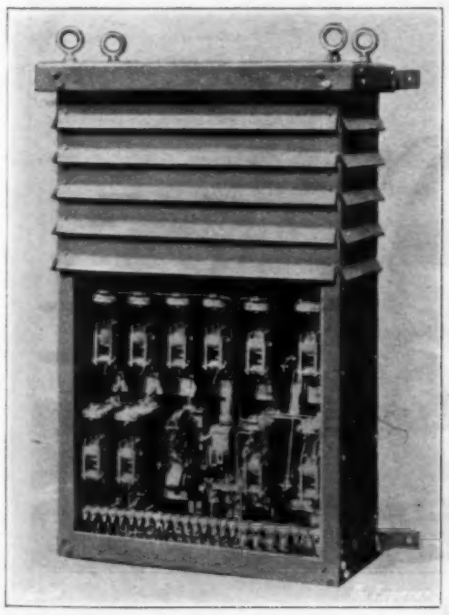


FIG. 58—CONTRACTOR CONTROL CUBICLE

drums may be worked together or independently, this being effected by means of a clutch which disconnects the barrel from the main shaft. Arrangements are made to prevent the barrel from rotating when the clutch is in the "out" position. In the intermediate position the barrel can rotate freely on the shaft. The barrel is fitted with gun-metal bushes in which the main shaft revolves freely when using the warping drums, and is controlled by the positive cast iron clutch referred to above. The warping drums are securely keyed to the ends of the main shaft.

The gearing consists of double reduction spur gear, the wheels being of semi-steel driven by pinions of cast steel, all having machine cut teeth. A foot brake is fitted with a wrought steel band acting upon the brake sheave on the barrel.

The motor is series wound, with a speed-limiting shunt winding, and is of the totally enclosed water-tight type. The bearings are of the roller type, and are enclosed in water-tight housings. In the insulation of the motor mica is employed wherever reasonably possible, otherwise the windings are impregnated under vacuum. A final coating of hard air-drying varnish is then applied, rendering the coils practically impervious to moisture. The magnetic brake, which is enclosed in a water-tight steel casing, is mounted in the commutator end bracket. It is normally in the on position, and is released immediately the controller handle is moved to the first running position. A hand lever is fitted so that the magnetic brake can be released, thus allowing the load to be lowered in case of emergency. The winch foot brake is interlocked with a switch so that in the event of the brake being applied with the controller in the on position, current is immediately cut off from the motor, but the magnetic brake is still held off. When the foot brake is released the motor will run at a slow speed, but can be accelerated by again operating the controller. In view of the unskilled labour so often employed in the handling of cargo winches, the master controller is of specially sturdy construction, and is so designed that the operating lever can be swung from full speed "hoisting" to full speed "lowering" positions, or *vice versâ*, without causing any damage to the equipment, whilst, on the other hand, heavy or light loads can be slowly moved through fractional distances. It is completely water-tight and is mounted on the winch—the method of operation being similar to that of the standard steam winch. This controller is of the drum type with mica-iron construction throughout, and incorporates a simple device for the automatic acceleration of the motor. Only shunt currents are dealt with by the controller—the main current taken by the motor being confined to the contactor cubicle. The contactor cubicle—see Fig. 58—which is of the drip-proof type, is suitable for mounting in a deck-house or other sheltered position, and comprises a number of contactors of the mica-iron type with substantial contacts and powerful magnetic blow-outs. The operating coils are liberally rated with an ample margin of safety, and are specially insulated to withstand tropical conditions of climate. The resistance is mounted in the rear of the cubicle and is of the rustless, unbreakable type. These winches are made in three sizes for handling loads of 3, 5 and 7 tons.

Hunt and Mitton, Limited, Oozels-street North, Birmingham, exhibited a large variety of steam fittings, lubricators, boiler mountings, &c., among which there were several valves specially designed for dealing with high-pressure superheated steam. The outstanding feature of these valves is the adoption of a metal named nickloy for the valves and seatings. This alloy, the makers tell us, has a melting point of 2400 deg. Fah., and a tensile strength of 25 tons per square inch, while the Brinell hardness number is 245 when cold. At 800 deg. Fah. the tensile strength is 17 tons per square inch, and at 700 deg. Fah. the Brinell hardness is 196. The spindles of these valves are made of stainless steel.

On the stand of J. Samuel White and Co., Limited, of East Cowes, Isle of White, was shown a typical example of the firm's oil fuel burning system. Another exhibit of interest was one of the latest types of the "electromersible" pump, which is built by the company under the Reed Cooper patents. The accompanying illustration—Fig. 59—shows the general arrangement of a single-stage pump on test. In this system a centrifugal pump is combined with an induction motor in such a way that the water passing to the pump is allowed to flow through the rotor and to cool it. The stator laminations and coils are immersed in transformer oil. Considerable improvements have been made on the earlier design, and the pump is now standardised in eight sizes, varying from a 2in. pump to an 8in. pump, the series being designed to deal with outputs from 90 up to 1500 gallons per minute. Both single and multiple-stage pumps are being built, and the multi-stage, as well as the single-stage pump, is so made that the rotor,

FIG. 59—ELECTROMERSIBLE PUMP

with the impellers and diffuser passages, may readily be withdrawn from the pump without disturbing the water connections, the design being such that all the running parts can be easily examined.

We understand that these machines will be found to compare favourably in cost and dimensions with ordinary totally enclosed units, but are much lighter in weight, and the pump would certainly seem to possess many advantages for general mining salvage and dock work, and for chemical works and mines where, by reason of corrosive and gaseous atmospheres, the ordinary design is not suited to the work in question.

On the same stand, Mr. A. G. Browning, of 42, Whitworth-road, South Norwood, London, S.E., was showing several pumps, one of which we illustrate in Fig. 60. The peculiar feature about these pumps is the method employed to make a tight joint

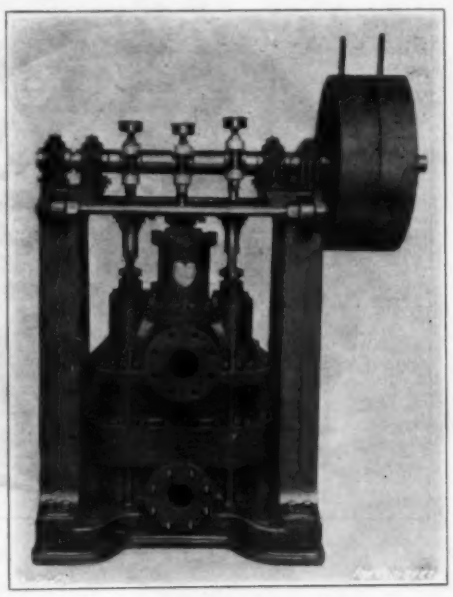


FIG. 60—BROWNING PUMP

between the piston, or plunger, and the barrel. In the place of the usual packing or cup-leather a labyrinth system is provided by forming the plunger as a series of concentric sleeves connected together at the top. The barrel, also, is built up in the same way, but the connection is at the bottom. The two systems of sleeves can be telescoped into one another, and need only be made a good sliding fit to provide a very effective packing, so that the power required to drive the pump is reduced in the proportion of the sliding friction of the ordinary packing to the

skin friction of the labyrinth arrangement. The pump which we illustrate is, it will be seen, of the three-throw type, and has plungers 5in. in diameter. The duty is 3500 gallons per hour against a head of 300ft. when running at 300 revolutions per minute. The inventor says that the efficiency of the pump is 98 per cent.

On the stand of the Tangent Tool and Engineering Company, Limited, Keynsham, Somerset, there were some examples of the excellent little rotary shearing machines which we have already described, together with photographs of some of the more recent machines designed by Mr. Smith, the chief engineer. Among the latter there were some pictures of the 250-ton

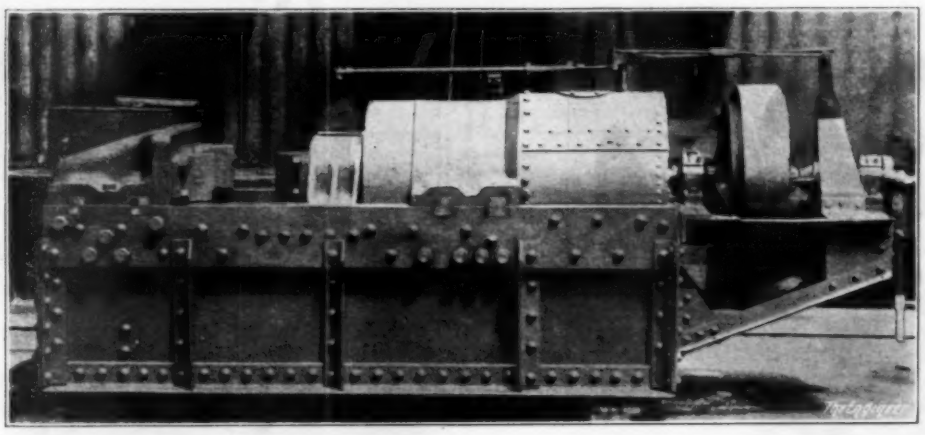


FIG. 61—250 TON OPEN-SIDED HYDRAULIC PRESS

open-sided hydraulic press, of which we give illustrations in Figs. 61 and 62. This machine is a self-contained portable semi-automatic plant, and is operated by a single lever which controls the clutch and exhaust valves simultaneously. The ram is spring-returned and overrunning is prevented by a knock-out gear coupled to the clutch and exhaust valve. When fitted with suitable anvils—as shown in Fig. 61—the press can be used for billet breaking, rail breaking, bending, joggling, &c. It can also be used for scrap shearing and section cropping. The pump, as can be seen from Fig. 62, is of the four-cylinder radial type operated by an excentric, which has three different throws, allowing for three different lengths of pump stroke. If the press is operated at constant power the number of ram strokes per unit of time can be varied; that is to say, the press can work at high speed on light work and slow speed at maximum capacity. *Vice versâ*, if the power can be varied or maintained at the maximum required, the press will then work at its maximum number of ram strokes per unit of time, independent of the load. Assuming a pressure stroke of 2½in. at 250 tons, the following table gives the approximate revolutions per minute of the pump shaft and horse-power required:—

Strokes per minute.	Revolutions per minute of pump shaft.	Horse-power.
1	30	4
4	120	15
6	180	23

The ram cylinder is a steel casting, while the ram, crosshead and end yoke are of close-grained cast iron. The pumps are of hydraulic bronze, the valves of cupro nickel, the pump containers of steel, the neck ring is of gun-metal and the frame is of the plate and section type. The machine measures 10ft. 2in. long, 2ft. 9in. wide and 2ft. 3in. high to the top of the frame. The maximum length of stroke is 4in., and the working pressure 4200 lb. per square inch. The whole weighs about 4 tons, and it can be mounted, if desired, on a heavy trolley for portability.

John Gibbs and Son, Limited, of 72, Duke-street, Liverpool, were demonstrating the waterproof qualities of their system of ship's ventilation, by means of a model on to which two streams of water were continually pumped. No moisture could, however, be found below the ventilator. This effect is produced by a series of vertical V-shaped baffles that deflect the water, and a conical bottom which ensures its draining outwards. In the case of the up-cast ventilator, an electric fan is arranged beneath to propel the air. These fans are substantially made, and their motors are totally enclosed in gun-metal cases with windows opposite the brush gear. There were also several fans or blowers for exhausting and for forced draught on the same stand.

A well-built and finished hot-bulb engine with a new type of vertical fuel pump was to be seen on the stand of the Anglo-Belgian Company, Société Anonyme, of Ghent, which company is represented in England by Mr. Edgar W. Dorey, of Norwich House, Southampton-street, W.C. 1. The fuel pump referred to is known as the R.E.M. pump and was designed by Professor R. E. Mathot. An illustrated description of it will be found in THE ENGINEER for February 2nd of this year. Its main features are that any desired number of pumps may be grouped round the central vertical shaft for multi-cylinder engines, and that means are provided for altering the timing of the injection of fuel whilst the engine is running. This control is valuable for adjusting the engine to its load. The example seen was a two-cylinder, 50 brake horse-power unit running at a speed of 380 revolutions per minute. The makers build land type engines in sizes varying from 10 up to 200 brake horse-power and marine motors up to 75 brake horse-power.

The new portable air compressing plant, which was shown on the Aster Engineering Company's stand, possesses several special features. The most important perhaps is the placing of the air reservoir which is used as a chassis frame. It forms an extremely rigid and strong foundation for the engine and compressor which are bolted to saddles welded to it, and carries cast steel drop wheel supports, while the supports for the springs are attached to it in the same manner. One advantage of this arrangement is that the makers are thereby enabled to employ a large receiver without its unduly obtruding itself, as would be the case if the receiver had to be placed vertically or in some other raised position. The importance of a large receiver is obvious. When a compressor of a given size is doing intermittent work, such as supplying air to a number of pneumatic concrete breaking or other tools for road work, the constant loading and unloading due to a small receiver as the number of tools in use is varied is minimised. There is also another advantage, namely, that with the very intermittent work of these tools a receiver of large size will frequently enable extra tools to be operated.

Returning to the constructional features, it will be seen from Fig. 63 that the cast steel bracket welded to the back of the receiver is provided with a double eye for engagement with a similar device on the lorry or tractor which pulls the plant, and that by operating the hand wheel and screw shown which terminates at the bottom in a circular frog, the front of the machine can be raised and lowered 8in. or 9in. to suit the height of the towing eye on the lorry. After the lynch pin has been inserted the machine is ready for towing and the front wheel is raised clear of the ground. Before beginning operations the lynch pin is removed and the hand wheel is again turned until the front wheel touches the ground and the frog is raised clear. An interesting minor addition to the plant is the provision of a spirit level on the base of the compressor, so that when standing on sloping ground it is easy by adjusting the front hand wheel to insure that the plant is perfectly level.

It will be observed that the front wheel is made to swivel so that the machine can be easily turned round to any required position before the frog is lowered. In order to enable the machine to be towed at a high speed, the main weight of the machine is taken by springs and solid rubber tired wheels. The engine and compressor, together with the radiator and tender, are so arranged on the receiver that there is just sufficient weight carried on the front wheel of the plant to insure steadiness when at work.

The engine is of the Aster four-cylinder vertical petrol type, designed to develop up to 15 brake horse-power at 1500 revolutions per minute. It is of the motor car pattern fitted with overhead valves and a detachable cylinder head, with a silent chain-driven cam shaft and throttle governor. Directly attached to the fly-wheel is a pinion which engages with a steel gear wheel having straight teeth of fine pitch and running in an oil-tight case attached to and communicating with the compressor casing, thus insuring ample lubrication. The pinion shaft is provided with ball bearings, and there is an outer bearing beyond the spur wheel on the compressor shaft. The compressor, constructed by Reavell and Co., Limited, is of the vertical two-crank single-acting type with automatic lubrication, and has a displacement capacity of about 80 cubic feet per minute at 100 lb. per square inch pressure. At the forward end of the compressor there is arranged a chain driven water-circulating pump and also a Whittle belt driven fan for the radiator. This is of ample size for cooling the water for both the engine and compressor, and the piping and the size of the pump are so designed

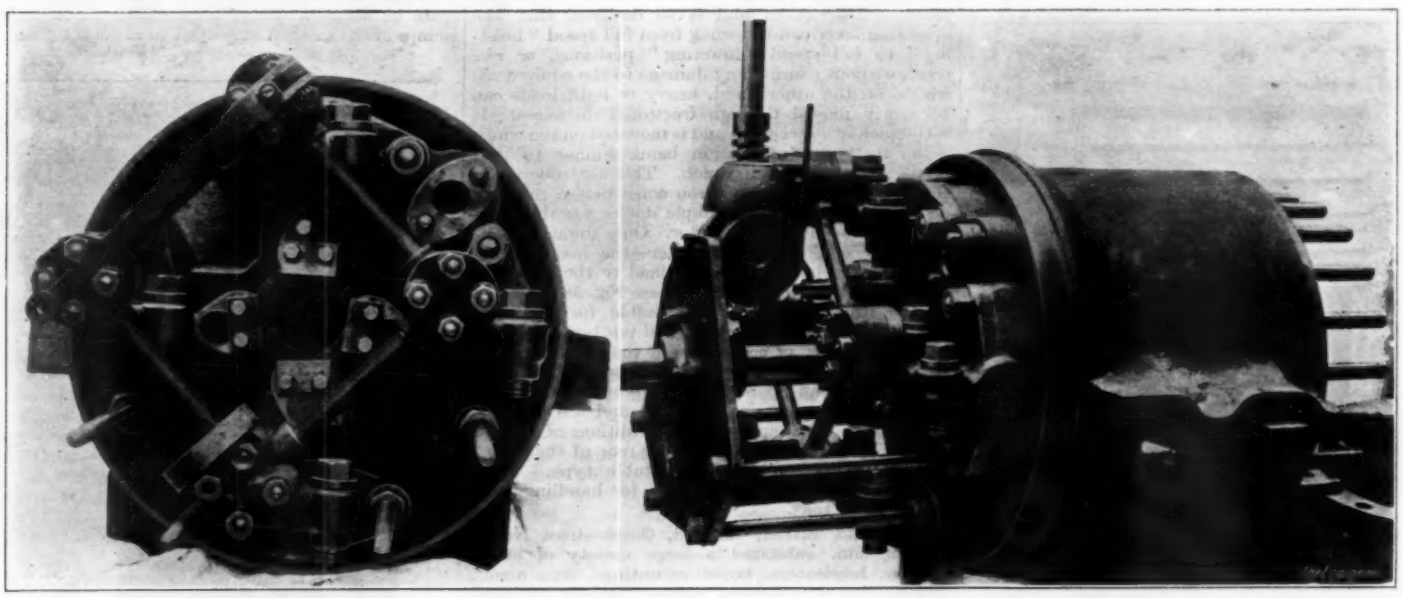


FIG. 62—FOUR-CYLINDER RADIAL PUMP FOR HYDRAULIC PRESS

that the water circulates relatively slowly, the object being that the water shall have plenty of time to cool in the radiator and pass first to the compressor.

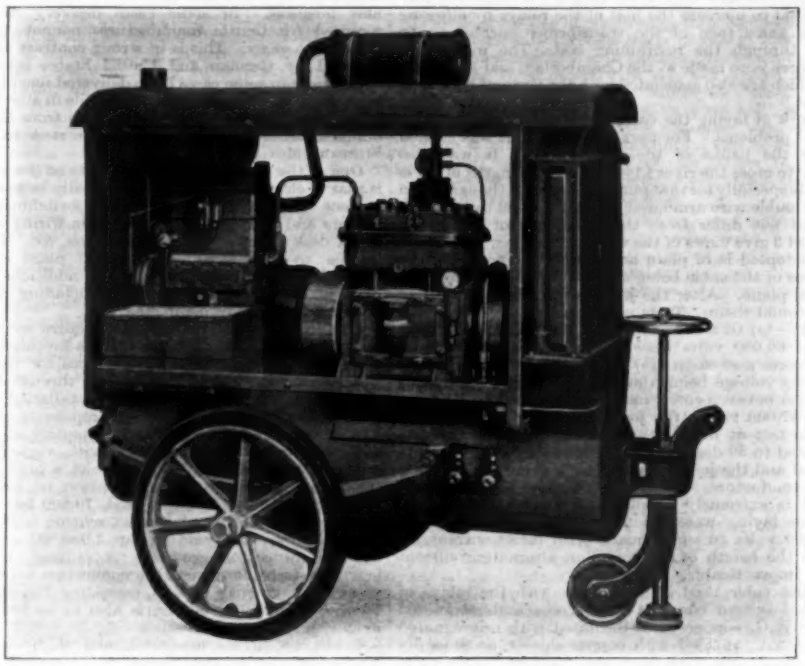


FIG. 63—REAVELL-ASTER PORTABLE AIR COMPRESSING PLANT

Passing round the jacket spaces of the compressor the water is raised to an inlet temperature, sufficiently high to insure the highest engine efficiency being obtained. The compressor fittings include an unloading device which can be set to operate within the desired limit for the tools in use, so that when the maximum pressure is reached the compressor is automatically unloaded, the air in the reservoir being retained by a back pressure valve. While unloading, of course, the engine is running almost light and the total power absorbed is comparatively small.

The entire equipment is enclosed and is covered on the top by a sheet steel roof supported by angle iron framing bolted to the receiver. The steel side panels are fitted with hand grips and are quickly removable. They are also provided with padlocks, so that the machine cannot be tampered with when not in use. On the steel roof is placed the exhaust silencer for the engine, and in a conveniently arranged position a large filling cap gives access to the petrol tank. The net weight of the complete equipment ready for use is only about one and a-quarter tons.

This unit forms the smallest of five standard portable sizes, which can be arranged for either electric motor, paraffin, or petrol engines drive, designed by Reavell and Co., Limited, for road repair, the demolition of buildings, the opening up of roads for gas and water mains, and similar purposes.

On the stand of Watts, Fincham and Co., Limited, there was a neat little force pump, made by F. W. Brackett and Co., Limited, of Colchester, which we illustrate in Fig. 64. One of the chief features about this pump is the arrangement of the valves, both suction and delivery, which are contained in a

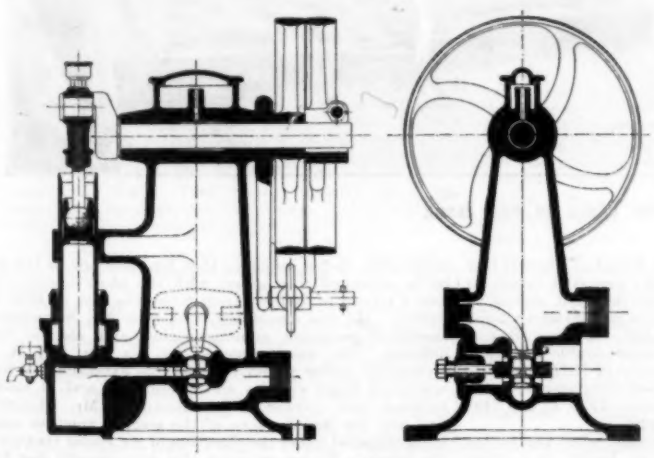


FIG. 64—BRACKETT PUMP

single removable unit. This unit consists of a taper plug accurately fitted into a ground recess, and is so arranged that by removing this plug—which constitutes the seating for the valves—the valve and seatings are all brought away together, and may be taken to a bench for grinding in and such repair as may be necessary. The plug can be taken out without breaking any joints or removing any covers since it fits metal-to-metal in the pump column, in the same way as the taper plug in a plug cock. The valve unit is secured in the recess by a single set screw and collar. On the removal of this set screw the plug may be gently tapped out with a piece of wood or drift, and in the event of its having become too firmly fixed to remove in this way, the set screw and collar, which were used to hold it in place, can be placed in position at the larger end of the plug and the plug withdrawn by means of the set screw. Another feature of the pump is the use of a ball and socket joint, in place of the usual gudgeon pin, for fixing the connecting-rod in the plunger. This joint works in an oil bath and allows the plunger to rotate, so that scoring is reduced to a minimum. It will be noticed that a substantial guide is provided for the plunger above the stuffing-box, while the standard forms an air vessel. These pumps are made in several sizes having capacities from 200 gallons up to 1500 gallons per hour and for heads up to 300ft. The speeds range round about 100 revolutions per minute.

Metallisation Limited, 1, Albemarle-street, London, W. 1, had a stand on which demonstrations were given of the Schoop process, which consists in the melting and atomising of the coating metal, or alloy, and impinging it as a fine spray on the surface to be coated. The spraying pistol, which weighs less than 3½ lb., is connected to gas and air supplies; the former for providing the means of combustion and the latter for providing the motive power of the automatic feeding device for the coating material, which is supplied in the form of wire. Oxygen-hydrogen, oxygen-acetylene, or oxygen-town's gas may be used under suitable pressures. The metal is automatically drawn from a reel into the pistol case, and fed uniformly and continuously, according to its melting rate, into the nozzle, where, entering a continuous reducing flame zone, it is melted and blown at a very high velocity in the form of a fine spray or mist, on to the work to be coated.

Another example of J. Samuel White and Company's products was the solid-injection oil engine, which is shown in Fig. 65. This engine, which is termed by the company a "super semi-Diesel," is the first two-cylinder model of a new series of engines which, it is hoped, will shortly be placed on the market in standard units. In addition to the crank-case scavenging which is commonly employed in an engine of this type, an extra charge of air is taken from the receiver of a double-acting supercharging pump mounted on the bed-plate at the end of the engine and directly driven from the crank shaft. This additional supply of scavenge air not only greatly augments the power developed in the cylinder, but at the same time gives increased flexibility, for provision is made to regulate the amount of supercharge *pro rata* with the power required. The engine is rated at 120 brake horse-power at a speed at 275 revolutions per minute. In designing the oiling system attention has been paid to economy of lubricating oil, and ducts cast in the bed-plate prevent the oil escaping from the forced lubricated bearings from passing into the crank casing. The pistons, gudgeon pins and crank pins are supplied from a special lubricator, excentric driven. It will be seen that the engine is generally robust in design, and particular mention may be made of the reversing gear and plate clutch, the latter of which is enclosed by the fly-wheel, and capable of easy adjustment from the outside. The clutch arrangement will, we understand, only be used on the single and two-cylinder units, and the four-cylinder engine will be made reversible, so that it may be coupled direct to the propeller shaft.

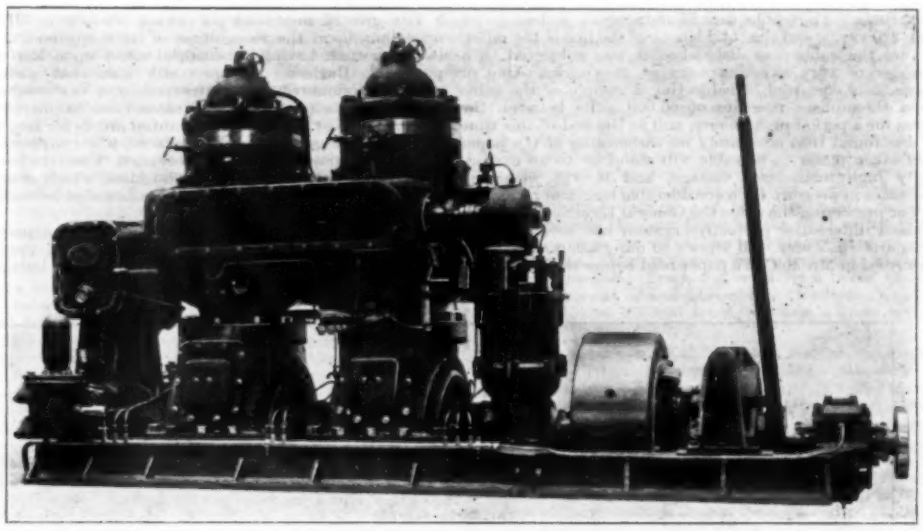


FIG. 65—WHITE SOLID INJECTION ENGINE

Right in the centre of the main hall there was an imposing display of the new "stream line" filter invented by Dr. Hele-Shaw, to which we made reference in connection with the conversazione of the Institution of Civil Engineers. This filter, it will be remembered, takes the form of a pack of sheets of impervious paper held together under considerable pressure. Passages for the liquid to be filtered are provided in the pack by perforating the sheets, and the liquid finds its way from one set of passages to the other by way of the interstices between the sheets—not through the paper itself. The foreign matter removed from the liquid remains behind in the inlet passages, and is removed from time to time. A new scheme for the latter purpose was shown at the exhibition, and takes the form of a plug, or plunger, in each inlet passage. By reversing the direction of flow this plug can be driven from end to end of the passage, and it naturally sweeps the *débris* out in front of it. The address of the Stream Line Filter Company, is 64, Victoria-street, S.W.

A High-tension Interconnector.

FOR interconnecting the Yoker and Clyde-mill power stations of the Clyde valley system, a large 33,000-volt cable has been laid. It was constructed at the Pirelli General Cable Works, which is one of the associated factories of the General Electric Company. Each of the three round cores has a section of .2 square inch. The thickness of the insulation between the copper is .512in. and from copper to lead .354in. The thickness of the lead sheath is .15in., that of each of the steel tapes .06in. The overall diameter is 3.55in., and the weight per mile

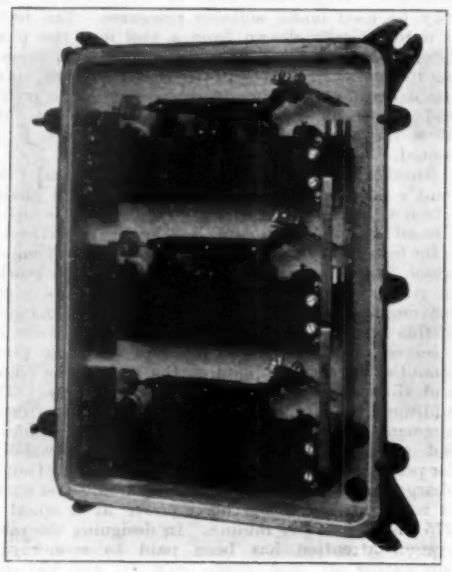


FIG. 1—RELAY

38.5 tons. The cable was manufactured in lengths of 200–220 yards, and the total length of the line is 15¼ miles. Before the cable was dispatched it was subjected to a number of very exacting tests at the works. One of these tests consisted of subjecting a sample of the cable to a three-phase pressure of 60,000 volts between the cores for a period of 24 hours, and at the end of this time it was found that absolutely no carbonising of the paper had taken place. The cable will stand up to an exceedingly high breakdown voltage, and it will withstand increases in pressure for a considerable length of time.

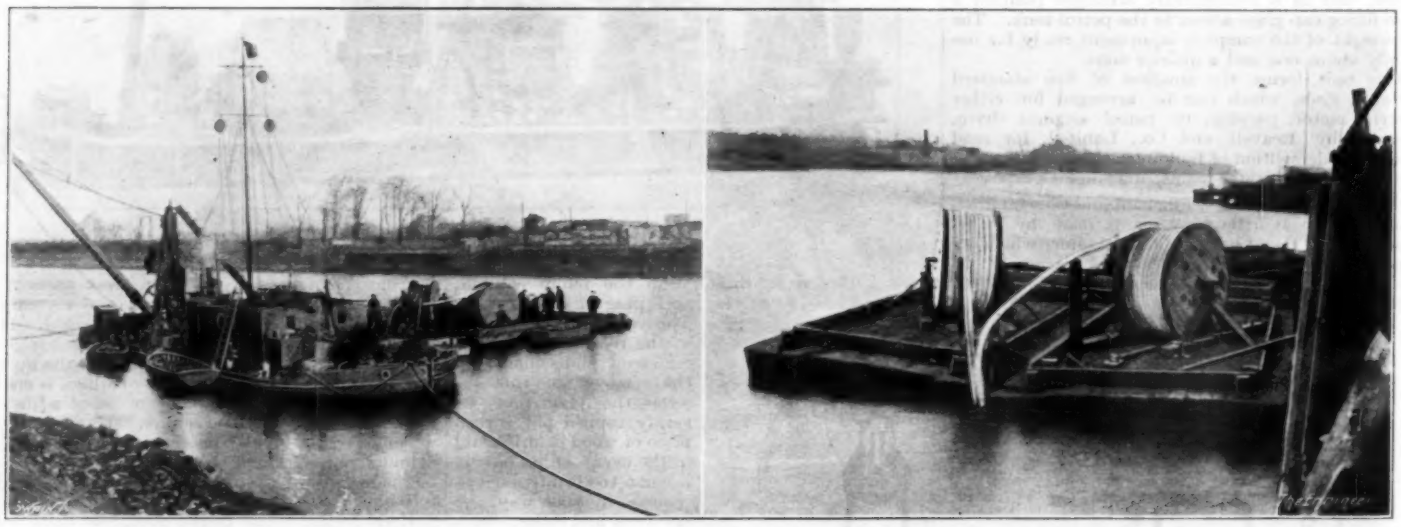
For protecting the cable the General Electric Company's biassed differential protective system has been adopted. This system is now well known to our readers, for it was described in Mr. McColl's paper read before the Institution of Electrical Engineers, and was also dealt with briefly in our issue of June 30th, 1922.

The interconnector on the Clyde Valley system has an 18,000 kilovolt-ampère 11,000/33,000-volt transformer bank at each end. A 1500 kilovolt-ampère bank of booster transformers is also placed at each end of the feeder, so as to compensate for drop in the line, and the inductive drop in the transformers when working at low power factors. The series transformers for the protective gear are connected on the 11,000-volt side of the transformers at each end, and protect the main transformer banks, booster banks and cable. The main transformer banks are delta connected for 11,000 volts and star connected for 33,000 volts. The neutral post of the 33,000-volt side is earthed solid on one bank and through a spark gap on the other bank.

A relay which in practice is mounted on a pedestal on the switchboard gallery is shown in Fig. 1. The relays have main and restraining coils and are of the beam type. The beam and coils are securely built up on the laminated iron circuit which forms the basis of the apparatus. The requisite number of duplicate resistances at one end of the feeder are contained in a box similar to that used for an ordinary motor starter resistance. On the top of this box there are three links, which are arranged so that either the normal resistance may be inserted or the resistance may be regulated to increase the bias of the relays by allowing a greater percentage of the transformer current to be diverted through the restraining coil. The instrument transformers were made at the Chamberlain and Hookham works, which are also associated with the General Electrical Company.

The work of laying the cable along the route gave rise to several problems. For part of the route it was carried alongside the banks of the river Clyde. It was also necessary to cross the river Clyde, and two lengths of cable were made specially for that purpose, but with the exception of being double wire armoured instead of steel taped these cables did not differ from the remainder of the cable. Figs. 2 and 3 give views of the work in progress. The type of joint adopted is of plain and simple construction, the three cores of the cable being divided out and jointed in a horizontal plane. After the joints were made a lead box was put round them. Tests made on joints at the works consisted :—(*a*) Of a routine test at double working pressure, *i.e.*, 66,000 volts between cores and 40,000 volts between cores and earth ; (*b*) a breakdown test as before, the limiting voltage being that at which the testing ends flashed over between cores, *i.e.*,176,000 volts, and for cores to earth 87,000 volts ; the joint did not break down ; (*c*) a six-hour test at double the working pressure with the joint heated to 80 deg. Cent., and afterwards the pressure was raised and the joint was broken down at 80,000 volts between conductors. The tests indicated that although the joint is extremely simple it is quite reliable. The tests after laying were (*a*) 92,000 volts between cores and 96,000 volts to earth, made with direct-current, as, owing to the length of the main, an alternating current test was impracticable.

The pilot cable used in connection with the relays of the McColl system contains three cores each composed of 7/20 S.W.G. copper wires insulated with impregnated paper but not provided with copper shields as generally used in connection with such relay cables. Two pairs of 1/20 telephone conductors are laid up with the relay cores, and these conductors are insulated with impregnated paper.



FIGS. 2 AND 3—LAYING A HIGH-TENSION CABLE IN THE CLYDE

British Trade with Mexico.

THE greatly improved political conditions in Mexico, attendant upon the recognition of its Government, are, it is reported, having a beneficial effect upon the trade position. Business, although still somewhat slack, is showing undoubted signs of revival, and the number of more important commercial transactions is increasing. During the past few weeks substantial orders for imported and domestic goods have been placed, while payments on accounts due have been more freely met. Until the passing of the dull period for Mexican business, which synchronises with the annual rains, no pronounced advance in commercial activities is expected.

Up to the time of the war British general exports to Mexico had shown a substantial increase, but they fell off notably after 1914. For the four-year period 1904–1908 the average annual value of United Kingdom exports had been £2,241,000 ; for the 1908–1913 period it increased to £2,309,000, but for the 1914–1918 period it shrank to £648,000. British imports into Mexico in 1920 were valued at £3,269,189 and in 1921 at £3,600,000. Although British exports to Mexico in 1920 were almost double the value of those in 1913, for the first six months of 1922 a decrease of over 60 per cent. was shown when compared with the previous half-yearly period as follows :—1920, £1,566,549 ; 1921, £2,896,170 ; and 1922, £954,526.

A favourable opportunity was missed when the feeling against the United States was at its height on account of non-recognition and the oil dispute. Several large importers—as was indicated at the time by the Central British Chamber of Commerce of Mexico—were anxious to transfer their connections from the United States to the United Kingdom ; but home manufacturers underestimated the possibilities of the Mexican market and allowed this chance of securing valuable orders to pass. Renewed friendly feelings with the United States are now expected to result in a considerable increase in business between the two countries.

British trade, on the other hand, has still to live down the bad effects occasioned during the war, when goods actually ordered were never delivered. Even to-day, long delays in execution and delivery of orders are preventing new business. In some cases delivery of machinery required for textile manufactures cannot be promised before two years. This is in strong contrast to the policy adopted by German and United States manufacturers. The former in some cases have delivered machinery within six months of receiving the order, while in another instance a German firm, being unable to ship from Germany, to oblige a customer diverted a plant *en route* to the United States to Mexico.

One of the most favourable markets at the present time is that of electrical equipment, especially large alternating-current generators, switches and switchboards, lamp holders and fittings, cables for house wiring work, small table, desk and port-hole electric fans, &c. The demand is due to extensive hydro-electric plant construction which is being contemplated and to additions to existing light and power establishments, including several new undertakings nearly completed.

Cast iron pipes of British manufacture are well known and highly reputed in Mexico. Some seventeen years ago —July, 1906—a large order for pipes for the Monterey waterworks was placed in Glasgow, through local representatives. The pipes, since their installation, have given complete satisfaction, few, if any, repairs or replacements having been necessary. A large quantity of iron piping will be required in connection with various irrigation schemes. In the river Yaqui district a project has been taken up by the firm of Richardson on behalf of the Government, on which, it is said, 70,000 labourers could be employed. A big plantation scheme is to be carried out in Lower California to tap 2,000,000 acres of land suitable for cotton growing. A railway, 150 miles in length, is to be constructed in connection with this enterprise. A large tract of land, exceeding 150,000,000 acres, on the Guatemalan border, is also to be brought under irrigation for crop cultivation.

Credit conditions are good, and shippers to Mexico employing the proper means of obtaining commercial information find small reason for complaint. It is admitted that, on the whole, Mexican merchants are good payers, and that it is safe to extend reasonable credit to the better-known firms. United Kingdom manufacturers and exporters, however, fail to appreciate this fact, and consequently obtain less than their share of business. To customers of known solvency, enabled to give first-class credit references, thirty days' credit is usually given from the date of the invoice, with a discount for cash varying between 2 per cent. and 3 per cent.; or credit of sixty to ninety days from the date of the invoice without discount allowance ; or, again, sixty to ninety days' payment after the receipt of the merchandise on acceptation of draft. In regard to this last certain firms charge interest of ½ per cent. monthly, while others make no charge for interest from the date of the acceptance of the draft.

FOR nearly fifty years the name of Houghton has been connected with the telegraphs on the Brighton Railway. The late Mr. E. J. Houghton had been the telegraph superintendent and electrical engineer for over thirty years, when he retired in October, 1909, and owing, in no small part, to his influence that line was one of the first to be equipped throughout with the block system, and had a record of 100 per cent. when the Act of 1889 was passed. He was associated, too, with Mr. Stroudley in electrical passenger communication and electric train lighting. He was succeeded by his son, Mr. R. H. Houghton, under whom considerable extensions of lock-and-block track circuits and telephones, and of electric lighting and power were effected. Mr. Houghton had also the maintenance of the electric traction equipment installed under the direction of Sir Philip Dawson, in his charge. Under grouping this arrangement has however, come to an end, and Mr. Houghton retired on the 31st ultimo. It is rather surprising and somewhat disappointing that the Southern Railway has not been able to retain the services of three such capable engineers as Mr. Billinton, Mr. Drury—the civil engineer—and Mr. Houghton, all comparatively young men too. The only chief officer of the Brighton to be retained is the goods manager.

Railway Matters.

THE last afternoon train by the Great Western route from Plymouth to London will, in future, leave at 6.20.

THE 9.50 a.m. and 12.15 p.m. expresses from St. Pancras have been accelerated so as to arrive at Glasgow 5 min. earlier than heretofore. The 10.45 p.m. from Glasgow leaves at 10.50, but is still due at St. Pancras at 7.50.

IN this column on July 13th a telegram from Dover to the *Manchester Guardian* was quoted as suggesting that the continental night mails would be transferred from the Dover–Calais to the Newhaven–Dieppe route. This transfer has now been made.

THE morning West to North express from Bristol *viâ* the Severn Tunnel has, hitherto, left that city at 9.45 a.m., and been due at Crewe at 1.40 p.m.—too late to connect with the 10 a.m. from Euston, and so passengers for Glasgow have not arrived there until 9.20 and those for Edinburgh at 9.21. From October 1st an express is to leave Bristol at 8.55 and catch the 10 a.m. from Euston at Crewe, and is due at Glasgow and at Edinburgh at 6.15. Connections will be given from Exeter, Taunton, and the principal stations between Taunton and Bristol.

THE retirement of Mr. W. W. Grierson, engineer-in-chief of the Great Western Railway, announced in this column on September 21st, reminds us that he came into prominence as resident engineer of the South Wales Direct Line, which was opened for passenger traffic on July 1st, 1903. On the death of Sir J. L. Wilkinson, and the appointment of Mr.—afterward Sir James—Inglis as general manager, Mr. Grierson succeeded the latter as chief engineer. He was a reporter on "Reinforced Concrete" at the Rome International Railway Congress in April, 1922, and read a paper on the same subject at the Engineering Conference in London in June, 1921.

THE *Ministry of Labour Gazette* reports that on September 1st the cost of living was 73 points above the July, 1914, level. As the pay of railway men is adjusted every quarter according to the cost of living, and as September 1st is one of the quarter days, this announcement is of interest, particularly as at the last adjustment—on July 1st—there was a deduction in pay of 2s. per week because of the fall from 80 on July 1st, 1922, to 69 on July 1st, 1923, *i.e.*, 1s. for every 5 points. On this occasion there will be no change, as the movement is of 4 points only. Had it been 5 points the men would have received another shilling. No change can now be made until December.

A CORRESPONDENT, who evidently has a better knowledge of British railway conditions than is usually shown by Americans who visit this country, has written to the *Railway Age* (New York) on some of the features which struck him on a recent visit to England. One is the presence of an ordinary brake van in the front or rear of the Pullman Harrogate express. Recently we saw a van at each end, and agree with our contemporary's correspondent that it spoils the look of an otherwise admirable train. He also mentioned the American 2–6–0 engines that were in use on the Midland, Great Northern and Manchester, Sheffield and Lincolnshire railways, and suggests that they were the fore-runners of the 2–6–0 type now so common in this country.

THE Wirral Railway, which serves the peninsula on the Cheshire side of the river Mersey, where many Liverpool business men live, having been absorbed by the London, Midland and Scottish Company, through carriages are now being run to Euston from New Brighton and West Kirby. They are attached at Hooton to the morning express from Birkenhead, and return on the 5.20 p.m. from Euston. The Great Western has retaliated by accelerating its Birkenhead service, but it cannot give through carriages; passengers join or leave the Great Western trains at Woodside (Birkenhead) and Rock Ferry. The 10.40 a.m. from Paddington arrives at Birkenhead at 2.57, p.m., 13 min. earlier than heretofore, whilst the express from Birkenhead, due at Paddington at 10 p.m., leaves at 5.25 instead of 4.35, a gain of 50 min.

THE Welsh people are the biggest patrons of the benefits to be found in the waters of Llandrindod Wells. The station there is on the London, Midland and Scottish system, and the only line in direct communication is that from Swansea to Craven Arms. Visitors from Cardiff, Newport, Merthyr and district pass over the Mid-Wales section of the former Cambrian Railway to Builth-road low-level station, and there mount to the high-level station and join the trains from Swansea. There is a loop line from the Mid-Wales railway on the north side of Builth-road station which passes behind the permanent way and signal shops and joins the Swansea line near the viaduct over the river Wye, west of the station. This line has now been signalled for passenger traffic and is used for through trains from the Mid-Wales line to Llandrindod Wells. Trains have already been run, though, on Mondays and Saturdays only, but from October 1st are to run daily.

IT was stated at the conference held at Chepstow on September 15th to consider an additional bridge over the Severn—to which reference was made on our Journal page last week—that, given alternative communication, the Great Western Railway Company would be prepared to scrap the Severn Tunnel. Convenient and absolutely necessary as this tunnel may be in its avoidance of the much longer route *viâ* Gloucester, it is a very costly piece of work to operate and maintain. No passenger train is, for instance, allowed to pass through the tunnel in less than 6 min., whilst the minimum time for goods, mineral and ballast trains is from 14 min. to 17 min. The gradients in the tunnel, which is 4 miles 624 yards long, are 1 in 90 and 1 in 100, and from the Bristol end there are 2½ miles of 1 in 68. The loading of passenger and freight trains is, therefore, limited. There is great expense incurred in ventilating the tunnel and pumping water away, and the cost of maintaining the track is necessarily high, because of the increased pay given to gangs working in tunnels and owing to their having to stand clear of the tracks for so much longer.

Notes and Memoranda.

A SOMEWHAT novel and generally unsuspected cause of petrol-fires, mentioned in *Nature*, is the power which the mobile spirit has of generating static electricity. Ignition of volatile oils through static discharge has been known in hairdressers' shops, in garages where men have chanced to clean their hands with silk rag soaked in petrol, in filling up petrol tanks of motor cars using a piece of chamois leather for filtration purposes. A still more curious case is that of the chauffeur who was drawing from a self-measuring tank into a can bearing a wooden handle; he hung the can by this handle, thus insulating the receptacle, and under these conditions the oil caught fire on two successive occasions.

A LARGE scale test of the value of different coloured paints for the reduction of evaporation losses from oil tanks will be made by the American Bureau of Mines. In the past many oil operators, especially throughout the eastern and the middle western fields, have adopted white or light-coloured paints for storage tanks. Tests previously made indicated that evaporation from tanks painted white averages about 1 to 1½ per cent. less than from tanks painted red, and about 2½ per cent. less than from tanks painted black. Tests made by the Institute of Industrial Research show that dark-coloured paints absorb heat to a considerable degree, and paints presenting a highly glossy surface are less absorptive to thermal rays than those presenting a matte surface.

THE United States Bureau of Standards, at the suggestion of a group of metallurgists connected with the automobile industry, has taken up the investigation of the carburisation of steel, a problem of great importance in this industry. The specific purpose of the investigation will be to determine whether or not the initial quality of a steel influences to any marked extent the results obtained in carburising practice as has been claimed by some commercial metallurgists. Specimens of "normal" steels, that is, steels which in the hands of these metallurgists prove to be entirely satisfactory, and of "abnormal" steels, those which gave results of a decidedly different character when subjected to the same carburising process, have been secured. The preliminary work of cutting the samples, making examinations of the structure, &c., is now under way.

A WATER-GAS tar emulsion is a tar having in suspension small droplets of water that do not readily separate from the tar. The percentage of water that can be thus retained may be as high as 85 per cent. The consistence of the emulsion depends, other things being equal, on the percentage of water dispersed in the tar. The greater the percentage of water present the more viscous the emulsion. At ordinary room temperature an emulsion containing 70 to 75 per cent. water is usually thick and buttery, but one containing 2 per cent. of water is approximately as fluid as a water-free tar. The size of the droplets of dispersed water is not the same in all tar emulsions or in any particular one, but other things being equal, the most obstinate emulsions, those having a high-water content and not settling readily, contain droplets of smaller average size than the less permanent emulsions.

SOME tests of fuels for house heating boilers, made in America, show that the efficiency was as high with by-product coke as with anthracite. In fact, two boilers gave somewhat higher efficiencies with coke than with anthracite. The efficiencies obtained with Pittsburgh and Illinois coal were 8 to 20 per cent. lower than that obtained with by-product coke. The Pittsburgh tests showed that about 10 tons of Pittsburgh coal was equal to 9 tons of coke, or 8½ tons of anthracite when the fuels were burned in one boiler; and to 10 tons of coke or 9 tons of anthracite when burned in another boiler. The Minneapolis tests showed that about 10 tons of Illinois coal was equal to 7½ tons of coke or anthracite when burned in a small, and equal to 8½ tons of coke or anthracite when burned in a larger boiler. With the same attention to the fire, coke gives a much more uniform temperature than bituminous coal.

THE Board of Trade has issued a pamphlet containing standard conditions and rules for the shafts of marine steam engines. These conditions and rules were framed by a conference constituted of representatives of the Board of Trade, Lloyd's Register of Shipping, the British Corporation for the Survey and Registry of Shipping, and the Bureau Veritas, and, as in the case of the standard conditions for cylindrical marine boilers published in 1920, and water-tube marine boilers published in 1923, were based to a very large extent upon the recommendations of the British Marine Engineering Design and Construction Committee. The Board of Trade is indebted to this committee for the very valuable work which it has carried out and which is now completed. It is hoped that the results of this work will enable an appreciable advance to be made in the direction of standardisation. The pamphlet containing the Standard Conditions is published by H.M. Stationery Office, price 1d. net.

ONE of the arrangements most favoured in America for reducing the risk of lightning setting fire to oil storage tanks is the use of a wooden top surmounting the metal body. This type of tank is open to the objection, according to *Nature*, that continuity of metal is broken, so that perfect protection from lightning cannot be assured. In this country all-metal tanks are preferred; sometimes steam-lines are led to the tops of the tanks for discharging steam freely at the approach of a thunderstorm, though in the case of large tank-farms the method proves impracticable. Tanks are usually built in the centre of sump holes, while a clearance of 200ft. between the site of each tank is desirable. Probably the most recent method for preventing oil-tank fires is that concerned with the use of "Sealite," an artificial preparation consisting of a mixture of glucose, glycerin, calcium chloride, glue and starch. This mixture can be rendered lighter than oil by aeration, and when pumped into the tanks it floats on the oil, thus preventing evaporation and also combustion. The better known "Foamite-firefoam" system of fire-extinction is only applicable once a fire has started; this depends on the foaming reaction set up by bringing together alum and licorice, by which carbon dioxide is generated, thus effectively choking the fire.

Miscellanea.

IT is announced that until further notice tractors may be imported into Russia free of duty.

THE Japanese authorities are reported to be undertaking an immediate survey of Yokohama Harbour with a view to carrying out repairs, the estimated cost of which is placed at 10,000,000 yen.

THE Canadian Department of Mines has received a block of silver ore weighing over two tons and containing over twenty thousand ounces of silver, from the Keeley mines in Northern Ontario. This is said to be the largest individual block of silver ore of such richness ever mined in Northern Ontario. It is intended to place it as a Government exhibit in the Parliament Buildings.

A MESSAGE from Santiago (Chile) states that the production of copper in Chile during 1922 was as follows:—Copper in bars, 109,420 tons; ore, 116,645 tons; manganate of copper, 110 tons. At the end of November 97,640 tons of bars, 104,025 tons of ore, and 101 tons of manganate had been disposed of. Chile has thus recovered her rank as the second largest producer of copper in the world.

THE Malay States Information Agency is authorised to state that the Government of the Federated Malay States up to September 25th, 1923, had disposed of 2000 tons of its stocks of tin held under the Bandoeng Agreement. It will be remembered that the parties to the agreement in April last decided to release stocks at the rate of 5 per cent. per month with authority to the parties to sell or hold the amount of their respective holdings so released.

A JOHANNESBURG message states that a decision in regard to the proposed big electric power schemes at the Witbank coalfield, on the Sabie Reserve, and in Rhodesia, all three of which have been favourably reported upon by the experts consulted, is eagerly awaited, as any one of them would provide a welcome stimulus to the engineering industry, although, of course, the plant required would be imported. The Electricity Commission will hold an inquiry concerning the Victoria Falls and Transvaal Power Company's Witbank scheme in the course of a few weeks.

ACCORDING to a message from Saigon (Cochin China) the arsenal, which belongs to the Naval Department, is about to be bought by the colony, which will sell it to a private company or a group of private companies. This arsenal was entirely constructed during the war, and possesses a modern equipment suitable for the construction of large vessels. The slip is 100 m. long and the repairing basin has a similar capacity. The arsenal covers over 25 acres. of land, and is situated on the bank of the river in the town itself. It could easily be used for repairs to vessels calling at Saigon and for the construction of river launches and junk tugs.

A MESSAGE from Secunderabad states that the largest project hitherto launched by the Nizam's Government has just been sanctioned at a cost of Rs. 3,05,000. The project will be known as the Nizamia Saugor project in the Nizamabad district, and will consist of a masonry dam across the Manjara River on the right of the village Mudodi, where the river has a drainage area of 8376 square miles. The reservoir has a capacity of 24,000 million cubic feet. From the reservoir a canal 62 miles long will proceed in a north-easterly direction. The area irrigated will be 275,000 acres, yielding a gross revenue of Rs. 58,00,000 annually.

THE second stage of the enlargement of the port of Paysandú, Uruguay, is now completed. Steamers can now berth alongside the new quay, which is linked up with the Midland Railway, while the three travelling electric cranes, each with a lifting capacity of 3 tons, erected thereon, insure the expeditious handling of merchandise. The work has extended over a period of four years, and with its termination there has been a revival of the agitation in favour of the construction of a railway from Rivera to Paysandú, which it is hoped would divert to Paysandú for shipment much of the produce from Southern Brazil that now goes to Montevideo. The Argentine Government contemplates investing the sum of 2,000,000 dollars in the dredging of the river Uruguay from Paysandú to Concordia.

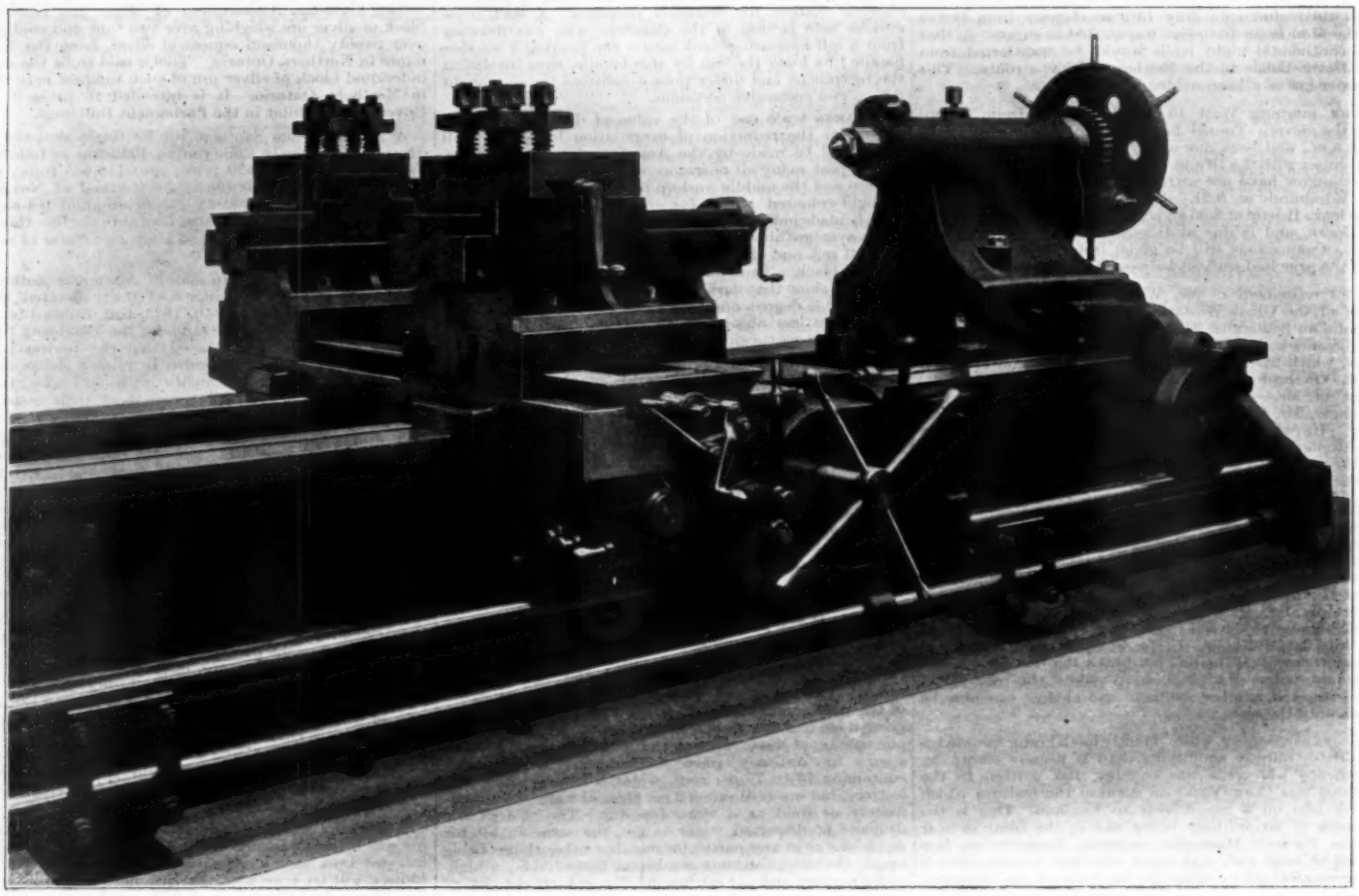
THE statistics of Australian trade for the year ending June 30th, 1923, show that the imports were valued at £131,808,673, as compared with £103,066,436 for the previous year, an increase of £28,742,237. Exports amounted to £117,913,083, as compared with £127,846,535 for the previous year, a decrease of £9,923,452. The balance of trade favourable to Australia in 1921–22, amounting to £24,780,099, thus became an adverse balance of £13,895,950 in 1922–23. The total value of imports of metals, metal manufactures, and machinery was £35,195,931, compared with £25,096,571 in 1921–22, of which chassis for motor cars were valued at £6,117,179, compared with £2,927,759 in the previous year. This extraordinary increase in the value of the imports of motor cars is regarded as an indication of the prosperity of Australia generally and of the growing feeling that a motor car is a necessity for the efficient conduct of town or country vocations.

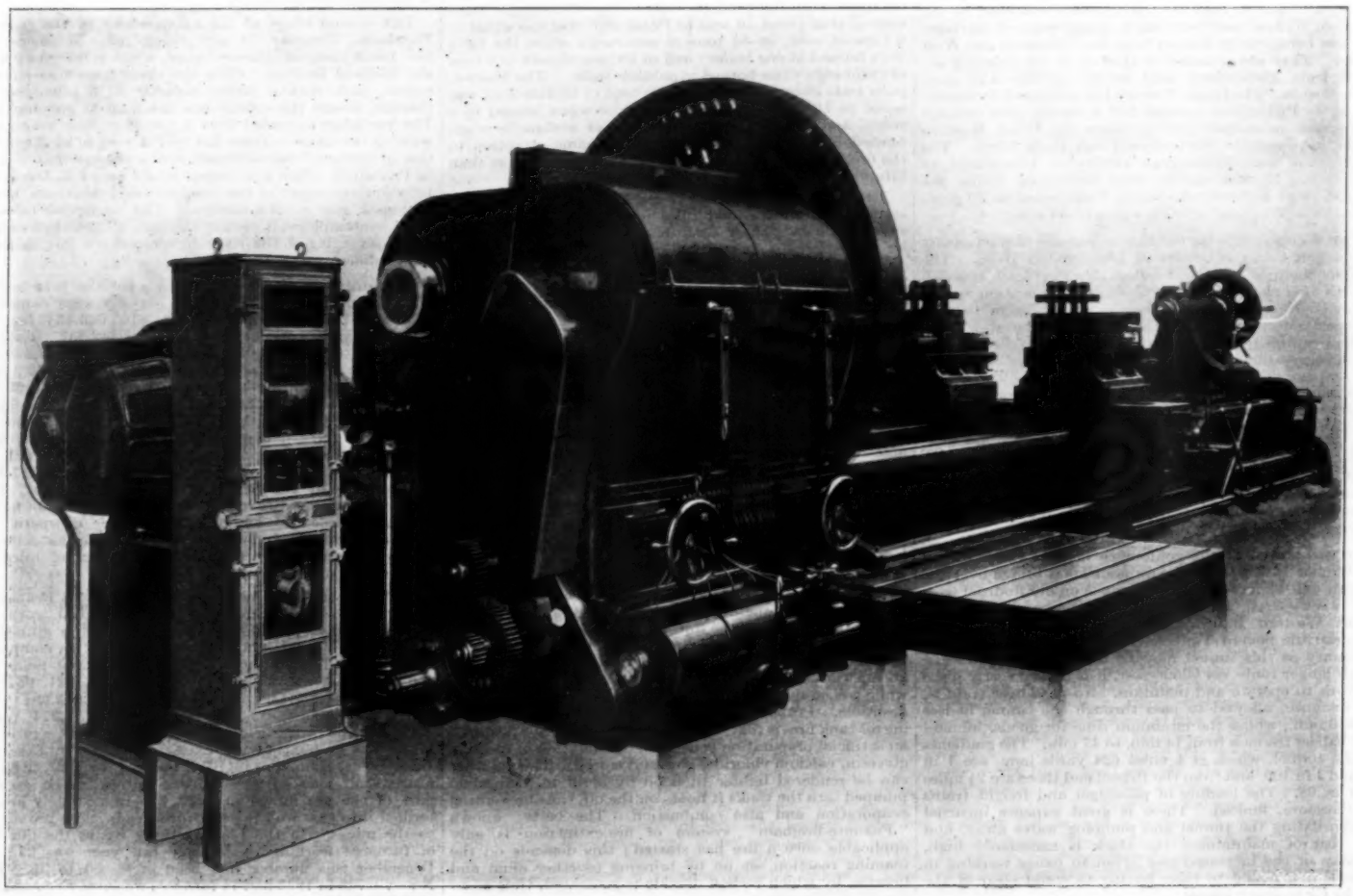
OFFICIAL statistics have been published in France in connection with the mines and metallurgical works in the Department of Meurthe-et-Moselle. The situation, it is shown, considerably improved in 1922 as compared with 1921. The output of ore in the different fields for the two years was as follows:—Longwy: 1921, 667,676 tons; 1922, 1,173,138 tons. Briey: 1921, 4,072,081 tons; 1922, 7,279,800 tons. Minières: 1921, 77,274 tons; 1922, 222,736 tons. Output in the Nancy field continues low. The amount of ore extracted from the Longwy-Briey fields, from zero in 1918, reached, in 1922, a figure nearly half that of the pre-war output. The greater part of the ore mined in 1922 was immediately transformed into cast iron in blast-furnaces in close proximity to the mines. In the Longwy-Briey basin, the number of furnaces working in January last year was 23; in December this number had been increased to 35. The Nancy basin in 1922 had 11 furnaces working, as compared with 7 in 1921.

THIRTY-TWO INCH BREAK LATHE

G. AND A. HARVEY, LIMITED, GOVAN, ENGINEERS

(*For description see page* 348)





AGENTS ABROAD FOR THE SALE OF

The Engineer

BUENOS AIRES.—MITCHELL'S BOOK STORE, 576, Cangallo.
CHINA.—KELLY AND WALSH, Limited, Shanghai and Hong Kong.
EGYPT.—CAIRO EXPRESS AGENCY, near Shepheard's Hotel, Cairo.
FRANCE.—BOYVEAU AND CHEVILLET, Rue de la Banque, Paris.
CHAPELOT AND CIE., 136, Bld. St. Germain, Paris.
BELGIUM.—W. H. SMITH AND SON, 78/80, Rue du Marché-aux-Herbes, Bruxelles, and 44, Rue Joseph II., Ostend.
INDIA.—A. I. COMBRIDGE AND CO., Bombay; THACKER AND CO., Limited, Bombay; THACKER, SPINK AND CO., Calcutta.
ITALY.—MAGLIONI AND STRINI, 307, Corso, Rome; FRATELLI TREVES, Corso Umberto 1, 174, Rome; FRATELLI BOCCA, Rome; ULRICO HOEPLI, Milan.
JAPAN.—MARUZEN CO., Tokyo and Yokohama.
AFRICA.—WM. DAWSON AND SONS, Limited, 7, Sea-street (Box 49), Capetown.
C. JUTA AND CO., Johannesburg, East London, and Grahamstown.
AUSTRALIA.—GORDON AND GOTCH, Limited, Melbourne, Sydney, Brisbane, and Perth, &c.
MELVILLE AND MULLEN, Melbourne.
ATKINSON AND CO., Gresham-street, Adelaide.
CANADA.—DAWSON, WM., AND SONS, Limited, 87, Queen-street East, Toronto.
GORDON AND GOTCH, Limited, 132, Bay-street, Toronto.
MONTREAL NEWS CO., 386-388, St. James-street, Montreal.
TORONTO NEWS CO., 42, Yonge-street, Toronto.
CEYLON.—WIJAYARTNA AND CO., Colombo.
JAMAICA.—EDUCATIONAL SUPPLY CO., Kingston.
NEW ZEALAND.—GORDON AND GOTCH, Limited, Wellington and Christchurch; UPTON AND CO., Auckland; J. WILSON CRAIG AND CO., Napier.
STRAITS SETTLEMENTS.—KELLY AND WALSH, Limited, Singapore.
UNITED STATES OF AMERICA.—INTERNATIONAL NEWS CO., 83 and 85, Duane-street, New York; SUBSCRIPTION NEWS CO., Chicago.

Agents Abroad for Advertisements.

UNITED STATES OF AMERICA.—BRITISH AND COLONIAL PRESS, Inc., 736, The Knickerbocker Building, 152, West 42nd-street, New York City.
FRANCE.—AGENCE VOX, 7, Rue de Surène, Paris (VIIIe).
BELGIUM.—W. H. SMITH AND SON, 78/80, Rue du Marché-aux-Herbes, Bruxelles, and 44, Rue Joseph II., Ostend.

SUBSCRIPTIONS.

THE ENGINEER can be had, by order, from any newsagent in town or country, at the various railway stations; or it can, if preferred, be supplied direct from this office.

Half-yearly (including index number) .. £1 12s. 6d.
Yearly (including two index numbers) .. £3 5s. 0d.

If credit occur, an extra charge of two shillings and sixpence per annum will be made.

Foreign Subscriptions will be received at the rates given below. Foreign subscribers paying in advance at these rates will receive THE ENGINEER weekly and post free. Subscriptions sent by Post Office Order must be made payable to THE ENGINEER and accompanied by letter of advice to the Publisher.

THIN PAPER COPIES.		THICK PAPER COPIES.	
Half-yearly	£1 11s. 6d.	Half-yearly	£1 13s. 9d.
Yearly	£3 3s. 0d.	Yearly	£3 7s. 6d.

(The difference to cover extra postage.)

Canadian Subscriptions—
Thin paper edition .. .. £2 18s. 6d. per annum.
Thick paper edition .. .. £3 3s. 0d. ,,

*** READING CASES, *to hold two copies of* THE ENGINEER, *cloth sides and leather backs, can now be supplied at 4s. 9d. each, 5s. 3d. post free.*

ADVERTISEMENTS.

*** The charge for Situations Open and Wanted Advertisements of four lines and under is four shillings and one shilling per line for each additional line up to one inch. When an advertisement measures an inch or more the charge is twelve shillings per inch. The rates for all other classes of advertisements, other than those mentioned above, are included in "THE ENGINEER Directory," which is sent post free on application. All single advertisements from the country must be accompanied by a remittance in payment. Alternate advertisements will be inserted with all practical regularity, but regularity cannot be guaranteed in any such case. All except weekly advertisements are taken subject to this condition.

Small Advertisements cannot be inserted unless delivered before TWO o'clock on Thursday afternoon (the day before publication). ALTERATIONS to STANDING ADVERTISEMENTS must arrive not later than THURSDAY of the week preceding publication.

Letters relating to Advertisements and the Publishing Department of the Paper are to be addressed to the Manager, all other letters to be addressed to the Editor of THE ENGINEER.

Postal Address, 33, Norfolk-street, Strand, W.C. 2.
Teleg. Address, "Engineer Newspaper, Estrand, London."
Telephone Nos. 2256, 2257 Central.

PUBLISHER'S NOTICES.

*** *If any Subscriber abroad should receive* THE ENGINEER *in an imperfect or mutilated condition, he will oblige by giving prompt information of the fact to the Publisher, with the name of the Agent through whom the paper is obtained. Such inconvenience, if suffered, can be remedied by obtaining the paper direct from this office.*

TO CORRESPONDENTS.

*** *All letters intended for insertion in* THE ENGINEER *or containing questions should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

*** *We cannot undertake to return drawings or manuscripts; we must therefore request correspondents to keep copies.*

By arrangement with Reuter's Engineering Service, **The Engineer** *contains the latest news from all parts of the world which is likely to be of interest to engineers.*

Contents.

THE ENGINEER, September 28th, 1923. PAGE

A SEVEN-DAY JOURNAL .. 329
SCIENCE AND INDUSTRY IN AMERICA.—No. III. (Illus.) .. 330
DESIGN OF PONTOONS. (Illus.) .. 331
BRITISH ASSOCIATION.—No. II. .. 333
THE SHIPPING, ENGINEERING AND MACHINERY EXHIBITION. No. V. (Illus.) .. 335
A HIGH-TENSION INTERCONNECTOR. (Illus.) .. 340
BRITISH TRADE IN MEXICO .. 340
RAILWAY MATTERS—NOTES AND MEMORANDA—MISCELLANEA .. 341
LEADING ARTICLES—
Cohesion .. 343
Master and Mechanic .. 343
LITERATURE .. 344
TECHNICAL EDUCATION IN CHINA .. 345
IRON AND STEEL INSTITUTE IN ITALY .. 346
THE BESSON COMMERCIAL SEAPLANE. (Illus.) .. 346
CANADIAN PATENT LAW .. 347
SIXTY YEARS AGO .. 347
OBITUARY—
James Alexander Phillips .. 347
32IN. CENTRE BREAK LATHE. (Illus.) .. 348
THE PENINSULAR AND ORIENTAL LINER MOOLTAN. (Illus.) .. 349
AUTOMATIC CONTROL OF LOCOMOTIVE CUT-OFF .. 349
THE "PARRY" BOILER TUBE CLEANING BLOWER. (Illus.) .. 350
THE ORLEANS SHIP CANAL .. 350
LETTERS TO THE EDITOR .. 350
IMPROVEMENTS AT THE PORT OF CHERBOURG .. 350
PROVINCIAL LETTERS—
The Midlands and Staffordshire—Lancashire .. 351
Sheffield—North of England .. 352
Scotland—Wales and Adjoining Counties .. 353
BOOKS OF REFERENCE .. 353
CATALOGUES .. 353
CURRENT PRICES FOR METALS AND FUELS .. 354
FRENCH ENGINEERING NOTES .. 355
BRITISH PATENT SPECIFICATIONS. (Illus.) .. 355
FORTHCOMING ENGAGEMENTS .. 356
PERSONAL AND BUSINESS ANNOUNCEMENTS .. 356
LAUNCHES AND TRIAL TRIPS .. 356

THE ENGINEER.

SEPTEMBER 28, 1923.

Cohesion.

THE discussion on cohesion, held at the recent Liverpool meeting of the British Association by a joint assembly of the three sections dealing respectively with physics, chemistry, and engineering, was in many ways highly stimulating and instructive, although it may not have produced anything directly useful from the practical point of view. As Sir Oliver Lodge neatly put it, there was some ground for surprise that at the present moment we should still find it necessary to discuss why it was that when we moved one end of a stick the other end moved too. This very obvious phenomenon would seem on the face of it to be extremely simple, but even this discussion, in which many of the leaders of scientific thought on these subjects took part, did not bring forth anything like a definite solution. Fortunately, the engineer and the practical man generally is well able to avail himself of a phenomenon long before the scientific investigator has found an explanation of it. In this particular case the phenomenon has received a very large amount of study, both from the purely practical and the scientific point of view, so that we have a great body of knowledge, known under such heads as "strength of materials," "theory of elasticity," &c., which has done much to clear up the laws governing the behaviour of matter when under stress. Even this knowledge of the behaviour of matter in the gross, however, is very far from complete, and this incompleteness leaves the engineer in so much doubt as to the way in which materials will behave in various circumstances that he dare not expose them to more than a fraction of the stresses which he believes they could really bear. Once again we are reminded of those "factors of safety" which, to a great extent, are really "factors of ignorance."

The engineer, however, is or should be interested in these problems not merely from the point of view of the behaviour of matter "in the gross." It is true that as a rule he has to deal with it only in the form of pieces of considerable size and is mainly concerned with their actual behaviour as parts of his structures or machines. But, for one thing, it is only a real advance in our knowledge of the internal mechanism of cohesion that can afford us a sounder insight into the factors which, in the end, govern the strength and endurance of materials. Thus, although fracture appears to be the parting of two large pieces of metal, it is essentially a parting of atom from atom, and until we know more of the ways in which atoms are attached to one another we shall not know very much more of the ways in which they can be detached, whether by steady stress, shock, or fatigue. From that point of view the work of Sir William Bragg and others on the space-lattice structure of crystals is of fundamental importance, while its recent extension to alloys by Rosenhain's theory of "lattice distortion" promises to bring a new order into our knowledge of metals. But of these things, however really important and interesting, they may be, the practical application cannot yet be seen and they may well be left, for the present, to the physicist and the scientific metallurgist. They are very certain, ultimately, to be fruitful of valuable practical results, but the engineer can do nothing with them in their present state of development and must await the time when they shall mature in his direction. Rather different is an idea which naturally arises from the views set forth by such physicists as Dr. A. A. Griffith and Professor Lindemann, who suggest that, on theoretical grounds, we might anticipate that materials should possess a strength some forty times greater than that which we find in practice, even in such a material as fully hardened steel. The vision of a steel having a tensile strength of the order of 4000 tons per square inch is almost too Utopian to be taken seriously by the engineer, and we should be tempted to dismiss the whole suggestion with the remark that a theory leading to such an idea must be grossly wrong, were it not for the fact that Griffith has actually succeeded in obtaining one substance—vitreous silica—in a state of super-strength, an extraordinary fact which tends to confirm the view that such extremely high degrees of tenacity are physically possible. To see a rod of this silica, more than an eighth of an inch thick, bent practically double and then allowed to spring back without damage, to see such a rod recover with practically perfect elasticity from an extension of 10 per cent., is so surprising that it furnishes food for thought. It is, of course, very unfortunate that the material, in this state of super-strength, is in a very unstable and sensitive condition. After the special preparation the surface must be protected from injury or even contact with other solid matter with extreme care. A touch of the finger is sufficient to reduce the material to a normal condition of weakness and brittleness, and even exposure to the dust carried by the air of an ordinary room soon spoils it. None the less, the fact remains that a degree of strength of an entirely super-normal order has been developed in some pieces of solid matter, and an understanding of the conditions upon which it depends and why ordinary materials fall so far short, is of the utmost interest—an interest which may at any moment become of the greatest practical importance. Dr. Griffith has put forward a theory to account for the weakness of ordinary matter, which, while perhaps more or less satisfactory from the mathematical point of view, it is difficult to regard as a real explanation. The deterioration of his super-strong silica he ascribes to minute injury to the surface, producing scratches or minute notches which cause fissures to start at stresses which would not affect the perfectly sound material. This may be so, although recent research seems to indicate that the importance of minute scratches has been very much exaggerated. Further, Dr. Griffith suggests that in ordinary crystalline materials failure is due to a species of internal unsoundness—the existence of extremely minute fissures, of practically molecular or atomic dimensions which are supposed to arise as imperfections—lacunæ, as it were, in the growth of the crystals when first formed.

Although Dr. Griffith supports this theory with great skill and ingenuity, we cannot help regarding it as highly artificial and fanciful. Indeed, there seem to be sound physical reasons why such minute fissures could not be formed in growing crystals. It is not, however, for us to pass judgment upon such a theory, nor even profitable to discuss it in detail. That, again, is for the scientific investigator. On the other hand, the physical possibility of the existence of "super-strong" matter has been demonstrated, and that is of very great interest to the engineer, who will need to watch carefully the progress of research in that direction. The possibilities which would be opened up if such materials ever entered the field of practical possibilities are almost too great to be easily imagined; engineering construction might be completely revolutionised. It is useless, however, to speculate upon such possibilities; yet we must not fail to bear them in mind.

Master and Mechanic.

MODERN developments in machine tools and other workshop appliances, combined with the insistence of the trades unions upon the adoption of a rigorous system of "demarcation," are commonly held to have wrought a sad change in the status and outlook of the mechanic workman. The truly skilled worker, it is often said, is fast disappearing from our midst, and in his place there is arising a generation, each member of which is an

expert in but one small section of his trade. It is undoubtedly true that division of labour and mass production methods do not afford the worker much opportunity to acquire skill and knowledge outside the boundaries of a very narrow field, and leave small room for the useful employment of the all-round mechanic. We cannot, however, appraise the position in this matter merely on the strength of an acquaintanceship, be it ever so complete, with modern conditions; we must of necessity also be acquainted with the conditions that prevailed five or six decades ago. By the big majority of us, the impression possessed of that past period has been derived from hearsay evidence. It is commonly dominated by the picture of the old-time millwright who, with equal facility, could make his own patterns and castings or his own forgings, and machine and fit them; who, without extraneous skilled aid, could carry a job through from the designing stage to completion. Such men certainly existed and still exist. But they were no more typical of the average engineering worker of sixty years ago than they are to-day. Indeed, a study of the evidence afforded by the files of this journal shows that the status of the mechanic workman has been very little affected by the great changes, mechanical and otherwise, which have taken place in the conditions of his employment. On the contrary, the evidence clearly indicates a great and significant change in the status of the master or employer.

Sixty years ago mechanical engineering was still an art. It was struggling to become a science and was modest in claiming for itself the dignity of a profession. It had barely emerged from the heroic period, and was still in intimate touch with the traditions established by the early masters. The engineering employer was still a Bramah, a Maudslay, a Nasmyth on a minor scale, a man who combined inventive ability, knowledge and experience with manual dexterity in the practice of his art. There was no recognised means open to all for the acquisition of engineering knowledge—the classes in the subject at King's College and at Glasgow University provided the only available opportunities for theoretical study. In the works, every possible restriction was placed on the escape of information. Those employed in the drawing-office were not allowed to go into the shops or even to speak to the workmen, and were supplied by the master with only just sufficient information to ensure the proper execution of their duties. The foremen, still more the workmen, were forbidden to enter the drawing-office and each kept everything concerning his own department carefully to himself. The master alone had complete freedom, and frequently would trust no one but himself with the designing and execution of portions of the work. This atmosphere of deliberate restraint and secrecy was generally cultivated in this country, for it was firmly believed that without it the prosperity of the industry would be doomed. Encouragement to persist in its maintenance was derived from the terrible example of what the opposite course had, so it was stoutly alleged, produced in America. In that country conditions as regarded the acquisition of engineering knowledge were almost the same as we know them to-day. Apprentices were entered without indentures or premiums. Each worked in turn upon nearly every class of work done in the factory, and was welcome to learn all that was to be learned in the place of his employment and in other factories which were freely opened to inspection. The result, according to the Americans, was to the good of the worker, the employer and the nation. But through British eyes, America was seen to be crowded with journeymen become masters. The numerous little factories scattered all over the land had produced a state of competition so keen that the profits of manufacturing engineers, it was said, were far below those of ordinary tradesmen. Many of the marine engine factories, most of the locomotive works, and nearly every railway carriage factory in existence in the States at the period we are reviewing had at some time or other been bankrupt, a fact regarded in this country as a direct consequence of the spread of engineering information. The picture of the wonderful old millwright type of skilled workman, in so far as it is intended to represent the *average* mechanic in the British engineering industry of sixty years ago, may be dismissed as a myth. The conditions were all against a worker acquiring a wide range of dexterity and knowledge. Having acquired such a range in spite of the restrictions placed in his way, he would have found it difficult to secure employment, for most masters would have regarded him as too dangerous to admit into their works. Furthermore, the rapidity with which engineering was developing and extending was all in favour of such a one ceasing to be a workman and himself becoming a master. Finely skilled workmen undoubtedly did exist in those days, and just as undoubtedly do they exist to-day. But as for the average mechanic there has been very little change of status. Sixty years ago artificial restrictions imposed by the masters for what they believed to be sound reasons prevented him from rising above average ability. To-day, with those restrictions things of the past, progress in machine tools and developments in factory organisation automatically serve a similar end.

If our dip into the past shows, as we hold it does, that there has been little or no material alteration in the status and capabilities of the average mechanic workman, it is clear that it cannot be said to present a similar picture on the master's or employer's side. Sixty years ago the Whitworth gun, the Whitworth machine tools—to take two of many possible examples—designated the products of a well-known individual's inventive capacity, possibly even, in some respects, of his own manual labour. To-day, in very many instances a similar personal reference hides the anonymous exertions of one who is no longer the master but a servant. It is the old race of employer, not the old race of workman, that is dying out in the engineering industry, and, inevitable though we may recognise such a change to be, it is not without regret that we record and ponder upon the transformation. It was inevitable, with the widening of the scope of engineering, the development of its scientific side, and the simplification of the methods of arriving at a desired result, that the master should, on the one hand, find it less necessary to play the principal part in the design and manufacture of his products, and, on the other, more necessary to engage the services of specialist servants familiar with modern progress. Processes of manufacture, which at one time called for the attention of a master mechanic, can now be executed—in some cases with better results—by unskilled labour equipped with modern appliances. The details of design that were once within the easy compass of one man's ability, have now passed into a complexity requiring the knowledge of half a dozen different specialists. The knowledge, skill, experience and manual dexterity which together went to the making of the old-time master engineer need no longer, or can no longer, be combined in the one individual. Even so, the change is to be regretted, for in very many instances it has resulted in a loss of personal contact, not only between the master and his workmen, but between the master and his work. Vainly may we strive to restore that contact by "welfare" and other schemes. The surest road an employer has to the respect and appreciation of his workman is by showing him that he himself commands the workman's trade and is a "master" in the full sense of the word.

Literature.

Timothy Hackworth and the Locomotive. By ROBERT YOUNG, M.I. Mech. E. 406 pp. The Locomotive Publishing Company, Limited, 3, Amen-corner, London, E.C. 4. Price 21s. net.

As a life of Timothy Hackworth, this volume makes interesting reading, as no complete biography had previously appeared, but as a serious contribution to the early history of the locomotive it leaves a good deal to be desired, and the critical student will find much with which to disagree.

The author states that the work of Timothy Hackworth, in establishing the success of the locomotive, has received scant attention and that there was a danger of his work being ignored altogether. His story has, therefore, been written with the object of presenting the real circumstances in truer perspective. It is compiled mainly from the manuscripts, letters and miscellaneous papers left by the late John Wesley Hackworth, and represents all the material available at the present time. It is not the author's intention either to decry the work of Hackworth's contemporaries, or to revive ancient controversy. No new claim is advanced on Hackworth's account, but what he accomplished is set out in greater detail than in any previous account of his life and work. It is, however, stated that John Hackworth, from 1850 onwards, was engaged in bringing his father's name into prominence, so that it is improbable that Timothy's name could be entirely forgotten; but John claimed far too much on his father's behalf when he sought to show that he was the only man who could build a successful locomotive, and that practically every important feature of the locomotive really originated with him. These extravagant statements naturally met with much opposition, and since the time they were made much evidence has been brought to light which effectually disposes of many of them; little of this later evidence appears in the book, and that little only to be discounted.

The author had here a splendid opportunity of justifying John Hackworth's statements by supplying the proofs hitherto lacking. It is regrettable to find, therefore, that he has apparently accepted everything said by that gentleman without critical examination. The documentary or other reliable contemporary evidence produced is very scanty; but much doubtful or second-hand evidence, or mere expression of opinion, is put forward, together with quotations from obviously ill-informed sources. Much surprise will be occasioned, for instance, by the frequent quotation of J. G. Pangborn as an authority, a man whose writings on railway history are now generally discredited, even in the United States.

It is impossible to deal fully with the book in the space available, but attention is drawn to some points of interest in the following notes.

Timothy Hackworth was born at Wylam on December 22nd, 1786, and after a seven years' apprenticeship at the colliery he rose to be foreman smith in 1807. It is stated that he became the principal figure in all the interesting experiments carried on there in connection with the introduction of the locomotive, and if that were so, one may wonder why, in 1811, Blackett called in Thomas Waters to build a locomotive when the locomotive genius Hackworth was at hand. A very circumstantial story of the Wylam locomotives is given, without, however, any proof of its correctness. From this story it appears that the first two-cylinder grasshopper engine was built in 1812 and not in 1813. Seeing that no drawing of this engine is known to exist, one doubts the wisdom of using a late drawing of "Puffing Billy" to represent it.

It is said of George Stephenson that he had the advantage of profiting by the practice and experience of others, but surely that remark applies even more strongly to Hackworth. In describing the 1814 engine, the astonishing statement is made that the wheels were roughened by protuberances in order to secure a hold on the rails. Stephenson and Dodd's patent drawing of 1815 is reproduced showing clearly the axles coupled by cranks and rods, and we have Robert Stephenson's authority for the fact that the 1815 engine was so made at first, but it is, nevertheless, maintained that Hackworth introduced the coupling rod in 1825. Losh and Stephenson's patent of 1816 is mentioned, but no notice is taken of the fact that it shows a six-coupled engine. It is now known that an engine of this kind was made in 1816, so that Hackworth's claim to that arrangement falls to the ground.

We learn that Hackworth had to leave Wylam in 1815 owing to his refusal to work on a Sunday, and he then removed to Walbottle, where he remained for eight years. His departure from Wylam is said to have resulted in no further locomotive development taking place there, but we look in vain for any locomotive development at Walbottle.

When the locomotive works of Robert Stephenson and Co. were founded in 1823, we are told that Hackworth was asked to go to them as manager, and he eventually went there, for a few months only, in that capacity. The foundation of this story has never been disclosed, but it is quite clear that Robert Stephenson managed the works from their inception until his departure for South America in 1824, and that Michael Longridge then took control. It seems far more probable that Hackworth was employed there as a smith. The story that George Stephenson offered half his share in the works to Hackworth if he would stay on may be gravely doubted, as well as the oft-repeated tale that Stephenson urged Hackworth's appointment as engineer to the Stockton and Darlington Railway in order to prevent his rivalry as an engine builder.

Dealing with the locomotives on the Stockton and Darlington Railway, many arguments are advanced to prove that none of the early engines were of any use, but at the same time we learn that Locomotion was rebuilt three times, a striking testimony to its real value. The difficulties of working the line are pointed out, but all its troubles are placed on the backs of the Stephenson locomotives, whereas conditions would have been the same, or worse, had no locomotives existed there.

Although official reports were made in the middle of 1827, showing clearly that the locomotives were cheaper than horses before the Royal George was built, the author refuses to believe the figures, but prefers to think that the reports were faked. He then repeats, from the *Practical Mechanic's Journal*, Vol. III., 1850–51, John Hackworth's mythical story that the directors had almost determined to abandon steam in favour of horses, and that the situation was only saved by Hackworth undertaking to build an engine to his own designs. A remarkable account is given by some German engineers of three designs for locomotives shown to them by Hackworth early in 1827. One of these was undoubtedly the design for the Royal George, and the report is interesting as stating that two of the axles were to be connected by levers. The story of the building of this engine is given in great detail, and the usual wide claims are made for it. Its increased heating surface and cylinder volume,

of course, made it a more powerful engine than any built up to that time; but while its design was suitable for slow coal traffic, it was applied elsewhere to a very small extent.

A truly remarkable story by John Hackworth concerning the locomotive afterwards known as the Experiment, shows how unreliable some of his statements were. He says that John Stephenson saw the Royal George during its trials and returned to Newcastle with a glowing account of its capabilities. Stephenson acted with his usual promptitude and secured a trial order for a locomotive of entirely new design, and great results were anticipated during its construction. As a matter of hard fact, this engine, which was delivered at Darlington on January 30th, 1828, was actually seen at Newcastle early in 1827, long before the Royal George was built. The author expresses great surprise that Robert Stephenson should have given to Walker and Rastrick an account of the work done by the most powerful locomotive then existing, the Royal George, rather than that done by his own less powerful engines. Some interesting letters between Stephenson and Hackworth, relating to the engines and their work, are given, but more of this kind of evidence is wanted.

The Rainhill trials and the building of Hackworth's Sans Pareil are described, while extracts are given from the important correspondence between Robert Stephenson and Henry Booth during the construction of the Rocket. It is pointed out, with truth, that it has not been sufficiently recognised that the Rocket was the joint production of Booth and the two Stephensons, but one may go further and credit Robert with the greatest share in its construction. The author repeats the statement that the failure of the Sans Pareil was due to the bad workmanship of Stephenson and Co., and that the cracking of a cylinder rendered the engine unable to stay the course. It is, however, very remarkable that the judges heard nothing of this at the time of the trials. Mr. Young seems to contend that the defects of the Sans Pareil gave an unfair advantage to the Rocket, and that it would have been more just to have awarded the prize to either of the failures than to the successful engine! The statement that there were influences unduly favouring Stephenson's engines on the Liverpool and Manchester Railway has been shown to be entirely devoid of foundation; those engines proved to be the only ones capable of doing the work, all other trial engines having failed.

The blast-pipe controversy is dealt with at length, but the fact that Trevithick applied it to his locomotive in 1804 is minimised, while doubt is cast on the evidence of Nicholas Wood and Robert Stephenson. It does not appear to be generally realised that the early locomotives did not need a very sharp blast, such as became necessary with the introduction of larger heating surfaces and restricted flues. It may be conceded that when the need arose, Hackworth, by contracting the end of the exhaust pipe, showed that any desired draught might be obtained. In speaking of the Lancashire Witch and its bellows blast, the author entirely misses the point that this was an entirely new experiment, made with the idea of burning coke, which was to be the fuel used on the Liverpool and Manchester Railway, and had nothing whatever to do with the blast-pipe controversy into which he drags it.

The building of Hackworth's Globe is dealt with, and it is shown that the designs were prepared early in 1830, but its construction is said to have been delayed by Messrs. R. Stephenson and Co. while they built the Planet. Hackworth designed some new six-coupled vertical cylinder engines with dummy crank shafts, which were built in 1831–2. The Wilberforce type of engine had a single flue opening into a chamber from which issued a number of small return tubes. This arrangement was patented by Napiers in March, 1831, but it is sought to show that Hackworth had anticipated them. Up to 1833 Hackworth had been engineer and manager of the railway, but, wishing to extend his general engineering business, he made an agreement with the company to contract for the working of the line. Reference is made to the heavy cost of repairs to the Liverpool and Manchester locomotives as compared with the Darlington engines, but we find from Pambour's records, which are given, that the latter, during five months of 1833, spent on the average more time under repair than in activity. The Royal George itself only worked for 11 days and was in repair for 121 days.

Extracts are given from Hackworth's ledgers covering his contract period 1833–1840, from which it appears that in one year the much-despised Locomotion earned for him the sum of £893. During this period he began to build locomotives for other railways, and while he introduced into them some novelties, such as the short-stroke cylinder, it may be noted that he had to adopt the now general six-wheeled design with fire-box and tubular boiler, as originated by the Stephensons in 1833. Hackworth appears to have retained his partiality for the vertical cylinder as late as 1840, while in 1838 he built what is called the first of a new and efficient class, the Tory, but this was simply a resurrection of the Rocket, supplied by Stephenson and Co. to the Darlington line in 1829. In 1840 Hackworth decided to give up the railway contract and devote his whole time to a general engineering business.

Some interesting stories of the old engine drivers are told, and the crude conditions of working are described. It is pointed out that the safety valves were often fastened down when the engines were running and explosions resulted from this practice. In 1846–48 Hackworth built some engines for the London and Brighton Railway to the designs of John Gray and fitted them with the latter's patent valve gear. In 1849 he built his last engine—Sans Pareil No. 2. It was a six-wheeled, inside cylinder, single driving engine of the then standard pattern, but it embodied many constructive features of interest; for instance, the longitudinal joints of the boiler were welded and its ends were flanged. It is claimed that it was a remarkably good engine, but no purchaser was found for it until 1854.

A short history of John Wesley Hackworth is given showing that he was born in 1820. He was evidently strongly biassed against the Stephensons, but there is no evidence of anything but cordial relations between Timothy and the latter. The summary of the work of George Stephenson is spoiled by too much quotation from Pangborn; few will agree that he lacked the inventive faculty, or that he did not improve the construction of the locomotive. He is given full credit as a railway maker, but it is difficult to see how Stephenson would have failed without the locomotive genius of Hackworth. D. K. Clark's extravagant opinion of Hackworth's work is certainly not borne out by facts, and a critical examination of Hackworth's supposed improvements shows that nearly all of them had been previously used by others. It must be concluded that Hackworth did only two important things in the development of the locomotive; he applied the simplest form of direct-acting steam engine to the locomotive, and he contracted the exhaust pipe to obtain increased draught. His engines had little or no influence on the general trend of locomotive design, and it is practically certain that he would never have claimed for himself all that was claimed for him by his son. Hackworth died on July 7th, 1850, and was buried at Shildon.

The book is well produced and excellently illustrated, and will give great satisfaction to those who believe that Hackworth was the real and true inventor of the locomotive; but others, more critical, will find the author's evidence insufficient and will hesitate to accept many of his conclusions. Yet, on the whole, we are glad that Mr. Robert Young, a direct descendant of the Hackworths, has presented what may be called the family traditions of Timothy in a collected form. Differ as we may from the opinion of the author as to the influence of Hackworth on the development of the locomotive, we agree willingly that the man himself was an outstanding personality in the engineering world a hundred years ago, and to have a connected account of his life is something for which to be thankful. Let us add that Mr. Young has produced a very readable book, and admit that whilst we cannot share his belief in the influence of Timothy Hackworth, we recognise that in presenting his case he has exercised more restraint than some writers, and that it is rather John Hackworth, than he, who speaks bitterly of the Stephensons and who claims, as a son may be excused for doing, more for his father than he really merited.

Technical Education in China.

(Contributed.)

THE more one reads about technical education in China from the pens of Chinese journalists and leader writers, the more one becomes convinced that China will never wake up to face realities, or cease to bow down and pay supreme homage to the god "Face." All that this means to China's millions cannot be expressed in a few short phrases. It permeates the whole of official and private life, with the result that a scheme with a high-sounding name will be assured of support, while any attempt to introduce reforms which aim at putting the fundamental principles right will be met with that passive resistance for which the Oriental is so justly famous. In no department is this tendency more marked than in that of technical education, and it is safe to predict that there are few technical students in China to-day who really believe that there is no royal road to a knowledge of engineering.

The latest scheme is that put forward by Yeh Kung Cho, who was Minister of Communications prior to the downfall of his party in the civil war of the summer of 1922. Briefly, there is to be a reorganisation and an amalgamation of the Engineering Department, Peking University, the Nanyang College, Shanghai, and the Engineering College, Tangshan, to form the Chiao Tung (Communications) University.

It may be of interest to recall that the Engineering College, Peking, is a combination of two separate schools, viz., Railway Administration, and Telegraphs and Posts, and that they came into being in 1917, following the decision to close the Training Institute of the Ministry of Communications. The Nanyang College was founded in 1897 by Sheng Kung Pao, then Director-General of the China Merchants' Steam Navigation Company, and head of the Imperial Chinese Telegraphs, and was known as the Government Institute of Technology. In 1904 the control was transferred to the Board of Commerce, but after the revolution in 1911 it passed to the Board of Communications. Prior to this transfer the College received its funds from the Steam Navigation Company and the Imperial Telegraphs; afterwards it was maintained by an annual grant of some 130,000 dollars (Mex.) from the Board.

The Tangshan College, considered by some writers to be the best technical institute in the country, was founded in 1905. It started as a railway school, and since that time it has been renamed out of all recognition, successively becoming the Engineering and Mining College, the Railway College, and in 1913 the Special Institute of Industrial Education. As stated above, it now becomes part of the Chiao Tung University. Since it was transferred to the Board of Communications in 1907, it has received its funds indirectly from the mother railway—the Peking-Mukden line. Tangshan, situated some 75 miles north-east of Tientsin, is the most important industrial centre in North China, and is the centre of the Kaiping coalfield, operated by the Kailan Mining Administration, the weekly output approximating to 80,000 tons. It also contains the Peking-Mukden Railway Works, giving employment to 5000 men, a large cement works and a modern cotton mill.

So far as the writer can ascertain, under the new order the Nanyang College will give courses in mechanical and electrical engineering, the Tangshan College will give courses in civil engineering only, and the Peking College will confine itself exclusively to wireless, telegraph and telephone engineering. In addition, a two years' preparatory school is to be established at Tangshan, and a middle school at Shanghai.

It appears that the amalgamation scheme formed the subject of a memorandum which was submitted to the President, and that the arguments supporting the proposal were based on the necessity of improving the then existing conditions.

Briefly, the defects referred to were:

(1) The duplication of courses, and lack of economy of effort.

(2) The majority of the graduates of the three institutions had gone into various walks of life for which no technical training was required.

(3) The impracticability of the education as given owing to the absence of intimate relationships between the administrative heads of the colleges and the Board of Communications, the former making no endeavour to ascertain the wants of the latter and to regulate their courses accordingly.

(4) The courses were believed to be not practical enough.

The promoters of the scheme claim that the new arrangements will eliminate these defects for the following reasons:—

(1) The Board is in a position to know the kind of technical training required.

(2) It will be in a position to give the graduates employment at the end of their technical training.

A cursory glance at excuses given and proposals made, might lead one to think that the authorities concerned had at last been brought to see the true state of affairs. It is the writer's studied opinion, however, that there is no cause for optimism, and he proposes to analyse the statements made in the light of his engineering experiences in China extending over seven years, three of which were spent as head of an Engineering Department in one of the Government Colleges.

The amalgamation of the colleges is, undoubtedly, correct in principle and may—indeed, should—give the economy of effort and co-ordination required; but to expect such a college reorganisation to be the cure for wasted technical talent is to show an ignorance of the facts and a blind disregard of the conditions now obtaining in China. The writer does not believe that lack of co-ordination has ever deprived students of satisfactory theoretical training, or that the instruction given was so inadequate that students who were successful in passing out were not qualified to be offered work on a remunerative basis by the Board. In fact, he is prepared to maintain that the reason why more of the graduates of the three colleges have not followed technical careers is simply due to lack of development or over-production of engineers, whichever way one cares to face the problem. It is manifestly absurd to expect any country to absorb yearly some one to two hundred engineers and experts on a total track mileage of from four to five thousand miles with all the postal, telegraph and navigation services thrown in. It is one thing for the Minister of Communications to promise employment, and another to find it, unless he is prepared to create sinecures. The real answer to such statements is simply this, that at the present time, old students of the Tangshan College, with four years' courses and the associateship of the college behind them and a further experience of two or three years on engineering works abroad, are looking for jobs. Statistics showing exactly the number of students who have kept to technical work and have found employment in the Board of Communications would make illuminating reading.

As regards the lack of practical training, in theory, at least, the way is simple. A student attends technical courses in order to learn certain elementary principles so essential in the application of scientific

knowledge to engineering problems. A knowledge of the processes and materials used can only be obtained in, or upon, engineering works, and it is to the shop he should go if he wishes to obtain such knowledge. Unfortunately, it is difficult to get students to see the value of such training. Although it is unwise to dogmatise too freely, it is safe to say that the old "quasi-caste" distinction (not hereditary) of men into four classes—(1) Shih, the scholar; (2) Nung, the farmer; (3) Kung, the artisan, and (4) Shang, the dealer—is not wholly eradicated, and in China proper, at all events, it is almost impossible to get the scholar to play the part of an artisan, even for relatively short periods. The writer has seen the experiment tried with six fourth-year students in one of the largest railway works in China. In the first place, the scheme was sanctioned only after repeated representations had been made to the officials of the Board of Communications, and, in the second place, the students were lazy, objected to the time limits and general restraint imposed, and generally wasted their opportunities.

It will be many years before technical education in China can be run on European lines. The apprentice or pupil at home takes his shop training as a matter of course, but in China the reverse holds, and the Chiao Tung University will fail, as its constituent colleges have failed, until such time as it refuses to grant engineering degrees and subsequent employment on purely theoretical training. Not 10 per cent. of the students who have graduated in Chinese colleges know the difference between a smooth cut and a bastard file, and men with less practical experience than that claimed by a third-year apprentice in England are given appointments as works managers. It is not for the really qualified man to grumble at this state of affairs. He is part of a system that encourages "Friend Pidgin," and that makes political feeling more important than engineering qualifications.

There is a touch of irony in the situation as it exists to-day, and one wonders whether in all the welter of proposals, counter-proposals and paper reforms, the Board of Communications has realised its own shortcomings. In the writer's personal experience this same Board has brought technical education to the point of ridicule by sending up "ploughed" students for three re-examinations in as many weeks, when such action could only be interpreted as an official order to pass these students.

If the Administrative Authorities and the Chiao Tung Pu wish to co-operate for the good of students who, according to the claims of one Chinese writer, have the potentiality of developing into the best technical men, and really desire to give them a training suitable to the needs of their country, they must do something more than introduce paper reforms. They must slow up the process of turning out fully qualified technical men by making a three years' course in, or upon, engineering works an integral part of the curriculum. It is, perhaps, needless to emphasise the fact that there are many good places under the control of the Board where such training could be obtained. In several, the student might eventually come to realise that many of his difficulties were due to the fact that his predecessors lacked the practical knowledge he was trying to acquire. Also, in time, he might realise that getting one's hands soiled was no disgrace, and that a country professing to strive for commercial prosperity must be prepared to eliminate those ideas of exclusiveness which hamper real progress.

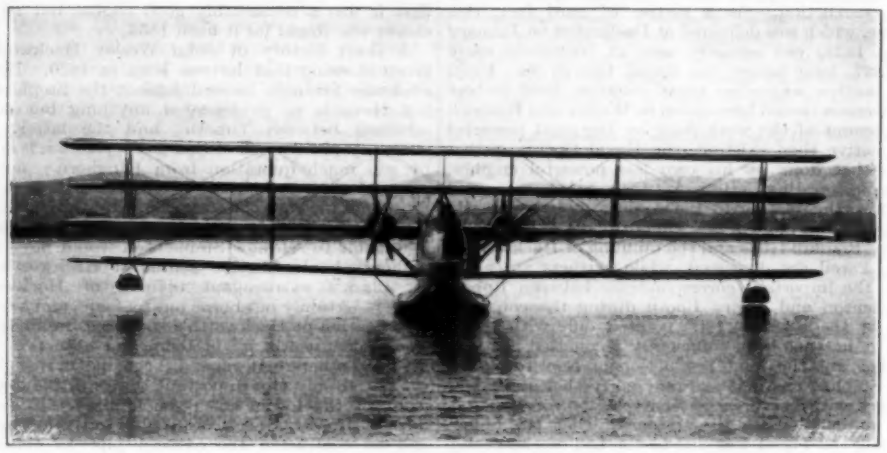
IRON AND STEEL INSTITUTE IN ITALY.

THE President and members of the Iron and Steel Institute paid a visit, on the 19th inst., to the Breda works at Sesto San Giovanni, near Milan. These works afforded proof of the high degree of development attained by the Italian engineering industry, especially in the matter of electrical plant, including electric locomotives and everything connected with the electrification of railways. In this sphere the Breda works are among the best equipped in the world. Count Sagramoso, the managing director, received the members of the Institute and replied to the address of the President. The Milan Municipality afterwards gave a reception in honour of the members of the Institute, in the course of which the Mayor, Senator Mongiagalli, delivered a cordial address of welcome. On the 23rd the members were received by the Premier, Signor Mussolini, who expressed the hope that the Institution's visit to Italy would further cement the long friendship and respect which had always existed between the two countries. Mr. Francis Samuelson, President, and Sir William Ellis, President-elect, responded, and expressed their appreciation of the very warm welcome and the hospitality they had received in Milan, Florence and Rome, adding that many of them were visiting Italy for the first time, and were greatly impressed with the importance and organisation of the works they had seen. The members afterwards motored to Tivoli, where they saw the waterfalls and were present at a luncheon given in their honour at the historic Villa d'Este by the Terni Steel Company. On the 24th the party left by special train for Leghorn.

The Besson Commercial Seaplane.

(By our Correspondent in Paris.)

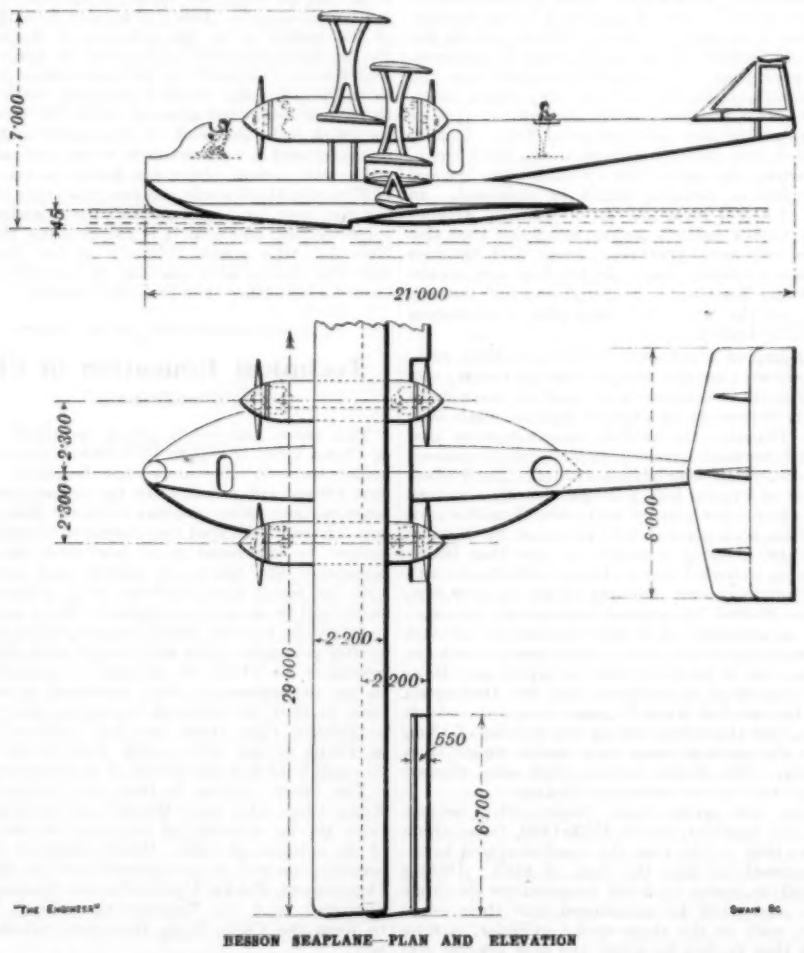
THE commercial possibilities of the aeroplane over land are limited by the competition of railways which, it would seem, will always carry the vast bulk of the freight at much lower cost than is possible by air and in a sufficiently short time. As an express service, the aeroplane is useful, especially between European capitals where considerable time may be gained on the journey. The possibilities, however, are considerably increased in the case of transport overseas, for the time saved in the carrying of freight may be a very important consideration, and the results obtained with existing services show that commercial seaplanes can carry full loads in competition with water transport. It is true that the line between Toulouse and Casablanca is served by aeroplanes which follow the Spanish coast and only cross the Mediterranean at its narrowest point; but the service is very successful, and it is intended eventually to supplement it with seaplanes crossing direct from Marseilles to Algiers, while it is proposed to organise a line of seaplanes between Alicante and Constantinople. If more has not been done with commercial seaplanes it is because types of machines have not been produced capable of carrying sufficiently heavy loads. The huge Caproni, with tandem planes, failed to give satisfactory results. Other machines have been built, but nothing is definitely known of their capabilities, and, therefore, special interest attaches to the Besson quadriplane which, for some time past, has been undergoing trials on the Mediterranean coast.



THE BESSON SEAPLANE

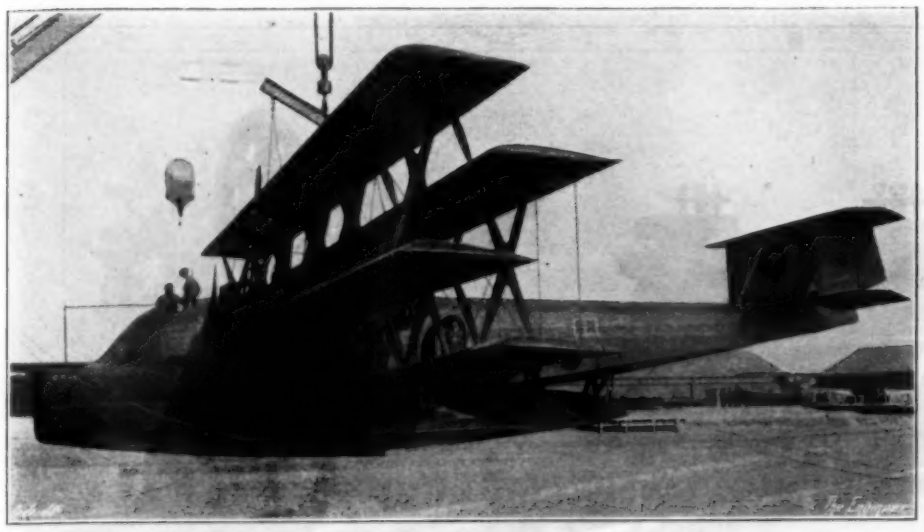
M. Marcel Besson has attempted to solve the problem of the commercial seaplane along purely economical lines; that is to say, he has not endeavoured to apply new formulæ of plane design, but has utilised existing methods of construction for a machine offering the maximum wing surface within the limits permissible for railway transport. M. Besson regards his quadriplane as a transition type between existing seaplanes and designs that may be eventually evolved out of new formulæ; but as new ideas and theories have not yet taken definite shape, he has made the best use of the materials at hand.

The construction of the quadriplane in no way differs from the ordinary practice. Wood is employed throughout, and all the parts are such that they can be made in any aeroplane factory. Facility of repair was a point considered in the designing of the machine. In view of the loads to be carried the bi-plane type would have involved the use of planes of an abnormal and impracticable width and depth, and as the dimensions must not exceed those imposed by the limitations of railway transport, it was found necessary to employ four planes. If the wings are exactly superposed, they react against each other, and hence M. Besson has off-sets them in pairs. This arrangement also multiplies the centres of pressure, and as the chord of the planes



BESSON SEAPLANE—PLAN AND ELEVATION

THE BESSON SEAPLANE



is 2.10 m., the displacement of the centres of pressure is very small, the result being to give good longitudinal stability to the machine. The planes are of fairly thick section, and each pair is built up with vertical cruciform wooden struts and steel wire stays, the two pairs being rigidly attached by the struts. The two lower planes are built into the fuselage. This design permits, it is claimed, of the construction of machines capable of carrying heavy loads. The Besson quadriplane, as illustrated herewith, has a width of 29 m., and a lifting surface of 255 square metres. The length is 21 m., and the height 7 m. It is fitted with four Lorraine engines, giving a total of 1000 horse-power, the engines being arranged in the usual way in pairs on the same axes with propellers fore and aft. With an unloaded weight of 5680 kilos., the quadriplane carries 1440 kilos. of fuel, and a useful load of 1560 kilos., making a total of 8680 kilos., or 34 kilos. per square metre of surface.

The full engine power is employed for rising from the water, two of the engines being subsequently cut out, so that with 500 horse-power this type of machine is able, it is claimed, to carry a paying load of more than a ton at a speed of 75 miles an hour. At a height of 2000 m., with three-fourths of the nominal power, a speed of 95 miles an hour may be attained. According to M. Besson, his system of multiplane construction will allow of practical and easily controllable machines being constructed having a wing chord of 3 m. and a surface of 460 square metres. With 3000 horse-power engines, such a machine would have a total weight of 22 tons, including 4 or 5 tons of cargo. These calculations appear to be confirmed in a certain measure by the results obtained with the machine, which has already successfully undergone prolonged tests. The tests show that with the speeds attained it may be possible to get the cost per ton-mile down to a figure that will make air freights sufficiently attractive for the rapid transport overseas of certain classes of goods, the chief revenue being, however, derived from passenger traffic.

A feature of the Besson seaplane is its combination of fuselage and detachable float. The fuselage is very spacious and carries at the end a cellular tail structure composed of three vertical and two horizontal planes. The central vertical plane is for steering, and those on each side serve for correction in the event of one of the engines stopping. The top horizontal plane is employed for rising or descending, and the bottom plane serves to adjust the machine to suit the distribution of load in the hull. The control is effected entirely by means of rods and bell cranks, no wires or cables being used for the purpose. The fuselage is at present arranged to seat twenty passengers, and there is plenty of space for luggage. It has a flat bottom and is quickly fixed to the float by means of ten bolts. The float extends for about two-thirds the length of the hull. It has a width of 3.50 m., and the upper part constitutes a deck for boats to come alongside. It is built of three-ply mahogany, and has twenty water-tight compartments. The float gives great buoyancy to the machine and raises the centre of gravity, thereby ensuring vertical stability and at the same time ensures that the passengers are well above the water level. The primary object of the detachable float is to protect the machine from damage. By far the greater proportion of seaplane accidents are caused by shock when the machine comes down too heavily on the water or the sea is fairly rough. The strongly built float with water-tight compartments not only reduces the risk of damage, but, in the event of its buoyancy being impaired, it can be easily replaced. Moreover, it can be removed and a landing chassis fitted instead if required.

In view of the consistently good results obtained during the prolonged tests of the Besson quadriplane it would appear that it marks a distinct advance in commercial seaplanes and shows at least that there is something in the theory that multiplanes with a depth of not more than 3 m. offer a better solution of the problem than monoplanes or bi-planes which, to carry the same loads, would probably be cumbrous and difficult to control.

Canadian Patent Law.

RECENTLY an Act was passed in Canada to amend and consolidate the Acts relating to patents of invention, and as it has just come into force it will be well for inventors to realise that material changes have been made in connection with the patenting of inventions in Canada.

Prior to the coming into force of the new Act patents could validly be obtained even after a British patent for the same invention by the same applicant had been sealed in this country if the Canadian application were lodged within one year after the British grant had been made. This procedure has now been changed, and the present law follows the United States practice.

According to the new Act, any inventor who elects to obtain a patent for his invention in a country foreign to Canada, before obtaining a patent for the same invention in Canada, must, if he desires to obtain a Canadian patent, apply within one year from the earliest date on which an application was filed in the foreign country or from the passing of this Act if no patent has been issued on a foreign application for the invention for more than one year. A patent must cover a new or useful art, process, machine, manufacture, or composition of matter or any new and useful improvement in any art, process, machine, manufacture, or composition.

A specific clause is to be found in the Act in connection with the patenting of improvements to the effect that any person who has invented any improvement on a patented invention may obtain a patent therefor, but this privilege will not give him the right of making, selling, or using the original invention as patented, nor shall the patent for the original invention confer the right of making, vending, or using the patented improvement. It is also provided that on each application for a patent a careful examination shall be made by competent examiners to be employed in the Patent Office for that purpose. It is customary at the present time to make an examination, but whether the class of investigation will differ under the new Act remains to be proved.

The Commissioner has power himself to object to the grant of a patent if he is satisfied that the applicant is not by law entitled to it or if it appears to him that the invention has already been patented, unless he has doubts as to who is the true inventor.

The term for the duration of every patent under the new law is to be eighteen years, and presumably this period will be calculated from the date of grant of the patent and not from the date of filing; but this point is not quite clear from the Act itself. United States patents date from the time of grant, whereas British patents base their term on the date of application. Provisions are made in the Act respecting patents for inventions made by persons in the public service, the terms regarding such patents and the respective rights of the Government and the patentee.

Patents may be re-issued if they are found to be defective or inoperative by reason of insufficient description or specification. Re-issuance of a patent is based on United States practice. In this country there are no provisions whereby a patent may be re-issued, but it is possible to amend it after grant, provided the amendment is limited to certain lines.

It is particularly pointed out in the Canadian Act that, although patents may be assigned, the assignment is null if it be not registered. The law also considers the case of patents which may be valid only for parts. Until recently in Great Britain no part validity was possible, but under the Act of 1919 part of a patent may be valid whilst the remainder is invalid. Every patentee is bound to satisfy the reasonable requirements of the public in regard to his patent, and to that end the law says he shall adequately manufacture the patented article or carry on the patented process in Canada.

Provisions are to be found governing the manufacture of patented articles. A petition may be lodged to compel the supply of such articles, and the Commissioner has certain powers granted to him in this connection, and in connection with the working of patents generally. Default to manufacture to an adequate extent or on reasonable terms is dealt with as well as the imposition of unfair conditions by the patentee. Any person interested may present a petition to the Commissioner alleging that the reasonable requirements of the public have not been satisfied and asking that the patentee be ordered to supply the patented article at a reasonable price or grant licences for the use of the invention on reasonable terms.

If the patented article or process is manufactured or carried on exclusively or mainly outside Canada to supply the Canadian market with the invention covered by the patent, at any time not less than three years after the date of the patent and not less than one year after the passing of this Act, any person may apply to the Commissioner for the revocation of the patent.

Provision is made in the law dealing with the restoration and revival of patents on certain grounds, and it is provided that a patent shall not affect a person who purchased an article subsequently patented before the issuance of the patent. Every patentee is required under the Act to mark each patented article sold with the year of the date of the patent. Any patentee who sells or offers for sale any article patented under this Act not so marked, or not having an equivalent marking on its container, is liable to fine or in default to imprisonment. The same condition applies if, for the purpose of deceiving the public, any article not patented in Canada is offered for sale as patented.

SIXTY YEARS AGO.

IN our issue of September 25th, 1863, a leading article was devoted to a discussion of the nature of heat. In those days many, including Professor Tyndall and Sir William Armstrong, were beginning to believe, with Galileo and Bacon, that heat consisted of the motion of the ultimate particles of matter, although the form of the motion, whether vibratory or otherwise, was, as it still is, a matter for difference of opinion. In our leading article, while admitting that by means of the molecular vortex theory of heat it had been found possible to calculate the specific heat of gases in a very precise manner, we rejected the view that heat was motion and advanced our belief that it could be better understood if it were regarded as being in the nature of a repulsive force. That view still possesses a certain amount of attraction for the physical speculator, but we do not think that it could be made to agree with modern views regarding the properties and constitution of matter in general. In a small note we read of the death of Mr. Samuel Baldwyn Rogers, formerly of Nant-y-glo, who died in extreme poverty in Newport, Monmouthshire. Mr. Rogers was the inventor of the iron bottom for puddling furnaces, which, at the time of which we are writing, was in general use throughout the iron trade, and had proved of considerable practical importance in the industry. Unfortunately for Mr. Rogers, the invention was never patented, and so far from his receiving any reward for it, he was, it is stated, dismissed from his employment at a large ironworks in South Wales, on the ground that he had committed the indiscretion of publishing an elementary treatise on the metallurgy of iron. We learn that on hearing of his distress several persons connected with the trade came to his assistance with financial aid, but the help came too late. Our correspondent relating the story says that it furnishes another instance of the unhappy fate of inventors, who, in enriching others, have impoverished themselves, and that in the annals of the iron trade only too many of such instances may be found. In a paragraph entitled "A New Balloon," a brief account is given of an experimental airship built by Mr. S. Andrews, of New York. Its form was similar in shape to three cigars pointed at both ends and secured together, the whole being covered by a net which, by means of cords, supported a 12ft. car some 16ft. below the centre of the balloon. There is no mention of any engine being fitted, but we learn that the possibility of sailing against the wind was demonstrated, and the vessel was guided in any and every direction by a small rudder having an area of only 17 square feet of surface. In this ship we appear to have a precursor of the Forlanini (Italian) airship.

Obituary.

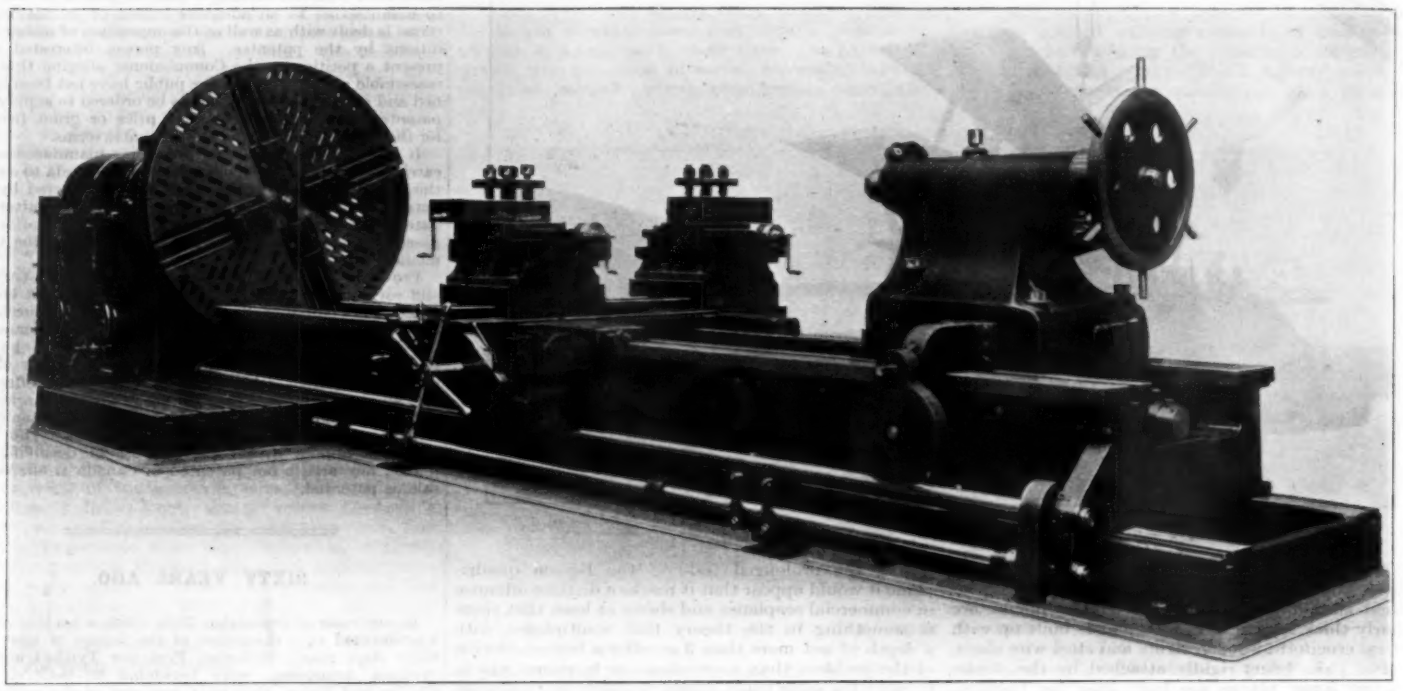
JAMES ALEXANDER PHILLIPS.

IT is with great regret that we have to announce the death, on September 23rd, of James Alexander Phillips, manager of the supply department of the British Thomson-Houston Company, Limited, of Rugby, with which company he had been associated for nearly twenty-five years. Mr. Phillips was well known to a very large number of engineers throughout the country, and his genial and courteous manner endeared him to all with whom he came into contact.

CONTRARY to the conditions in this country the railway companies in the United States are having to contend with large increases in pay, and have yet greater demands to be dealt with. The concessions already made will increase the annual pay-roll by 4 per cent. For good or ill each company is making its own terms with the men's unions, and thus, says the *Economist's* New York correspondent, if all the companies have to follow suit, the permanent way maintenance will cost 25 million dollars more a year, the wages of the clerks will be 15 millions more and of the shopmen 35 millions.

SURFACING AND SCREW-CUTTING BREAK LATHE

G. AND A. HARVEY, LIMITED, GOVAN, ENGINEERS



32in. Centre Break Lathe.

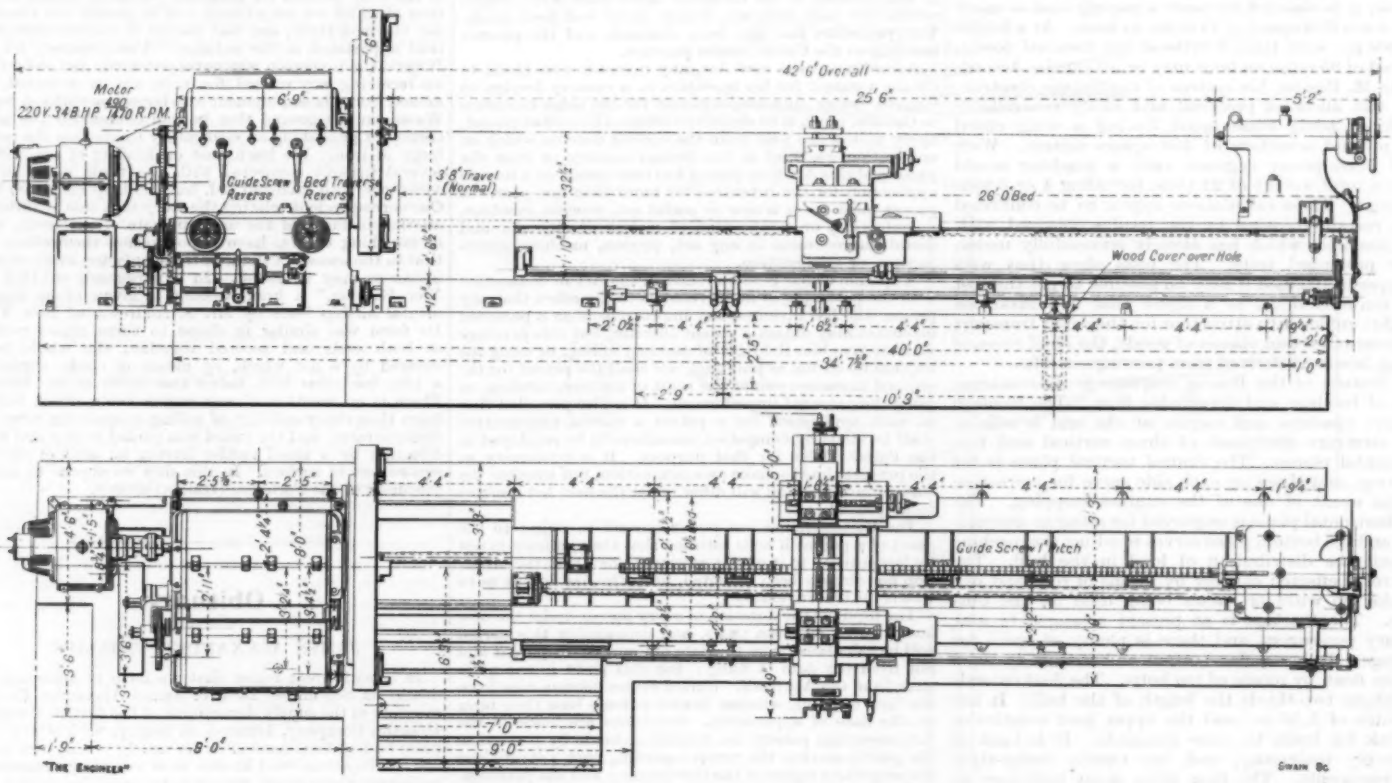
A 32IN. centre break lathe which possesses some interesting features has recently been constructed by G. and A. Harvey, Limited, of Govan, for Glenfield and Kennedy, Limited, of Kilmarnock. It is illustrated herewith and on page 342. It was designed to turn, bore, face and screw cut work of a diameter of 64in. over the bed, 51in. over the saddle and 25ft. long between centres with the gap opened out. It can also take work up to 8ft. 6in. in diameter and 4ft. 2in. in front of the face plate in the gap. The bed is 26ft. long, and is supported throughout its whole length, when the gap is closed, by a bed-plate bolted to the foundation. As will be seen from the half-tone illustration on this page, the bed is made to slide. It is capable of being moved 50in. back from the face of the chuck by means of a power-driven screw, and during the process the feed and screw-cutting gears maintain their connections at all positions of adjustment.

The driving headstock, which carries the gear shafts without any overhang, is 5ft. 5in. long by 5ft. 9in. wide at the base. It is secured to the stool by six heavy studs, and the back thrust is taken by a strong snug, while side adjustment for wear is provided at both ends. The gear wheels are all covered in with a planished steel dome, which is hinged so that it can be opened in sections. The gear engagement is controlled by two hand levers. The neck journal of the face-plate pinion shaft is made to run in capped bearings for convenience in overhaul, and the other gear shafts can also be easily withdrawn. An oil pump, driven by gearing off the motor shaft, forces oil into a vessel arranged at the top of the head, from which it flows through separate pipes to all the bearings in the head. The drainings flow back to the tank from which the pump draws, so that there is no waste.

The spindle of the shifting head is adjusted by hand wheel and forcibly screwed up by means of worm and worm wheel gear. The main spindle, or mandrel, is tapered from 12in. in diameter at the front journal to 9in. at the back. The bearings are adjustable, 18in. long at the front and 9in. at the back. A ball bearing is arranged to take the end thrust on the spindle and is provided with screwed rings at the back for taking up end play. The chuck, or face-plate, which is fixed on the mandrel, is 7ft. 6in. in diameter, and has a deep flange for stiffening its rim. Its rigidity is also increased by the internally toothed gear ring which can be seen fixed on its back. The chuck is a force-fit on the mandrel nose, and is secured by means of four fitted bolts. On its face there are four cast steel "grabs," which are each held down by six bolts and may be adjusted, for centring, by substantial screws. It is a simple matter to remove the grabs if a plain face-plate is required.

There are two compound slide rests on one saddle, one at the front and the other at the back of the bed. The feed motions for these slides are operated from the pinion shaft which drives the face plate, through a chain and two sets of gear that give six changes of speed. There is a splined shaft running along the front of the bed, which is driven from the feed gear-box and drives the transverse and longitudinal feeds of the slide rest through mitre reversing gears and friction clutches. The extent of the transverse feed is sufficient for cutting right across the face-plate at one setting. Only one of the two feeds can be engaged at a time. For screw-cutting purposes there is a screw running down the centre of the bed, which is driven off the face-plate pinion shaft through change wheels on a quadrant. The power for travelling the upper sliding bed is also obtained from this set of gears. A safety lock is, of course, provided so that the screw-cutting and travelling mechanisms cannot be put in operation together. There is also a quick power traverse for the saddle, which gives a speed of 8ft. per minute.

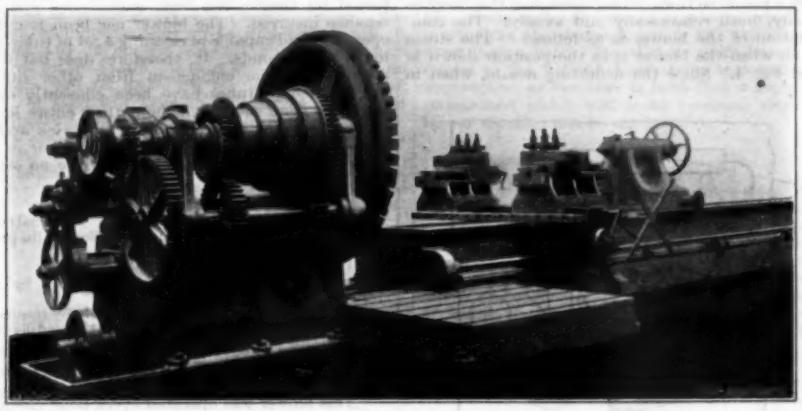
In front of the main bed-plate there is an extension, 6ft. 6in. long by 5ft. wide, on which a stool can be mounted for carrying a slide rest when it is desired to machine



GENERAL ARRANGEMENT OF 32-INCH BREAK LATHE

jobs up to the maximum capacity of the gap, viz., 8ft. 6in. in diameter.

The lathe is driven by a 34 horse-power motor by the Lancashire Dynamo and Motor Company, which has a speed variation between 3 and 1, and is intended for 220-volt direct current. The maximum speed of the motor is 1470 revolutions per minute. The motor is controlled by a Brookhirst pillar type regulator.



OLD PATTERN BREAK LATHE BY G. AND A. HARVEY, LIMITED

The leading dimensions and particulars of this lathe are given below :—

Diameter of swing over bed	65in.
Diameter of swing over saddle	51in.
Length between centres with gap opened out	25ft.
Width of bed over flats	4ft. 6in.
Maximum dimension of work in gap	9ft.
Maximum dimension of work in front of face-plate	4ft. 2in.
Length of sliding bed	26ft.
Width of sliding bed	4ft. 6in.
Depth of sliding bed	1ft. 10in.
Distance the sliding bed can be moved back from face of chuck	4ft. 2in.
Speeds—	
With quadruple gear	From 0.75 to 2.27
With triple gear	From 1.98 to 5.95
With double gear	From 4.93 to 14.8
With single gear	From 12.8 to 38.5
Chuck—	
Diameter	7ft. 6in.
Total weight including gear and grabs	73 cwt.
Feeds—	
Number	8ix
Longitudinal	8ix
Pitch of guide screw	1in.
Pitches of screw cutting which can be obtained	1/16in. to 2½in.
Floor space	42ft. 6in. by 11ft. 6in.
Approximate finished weight without electrical gear	38 tons

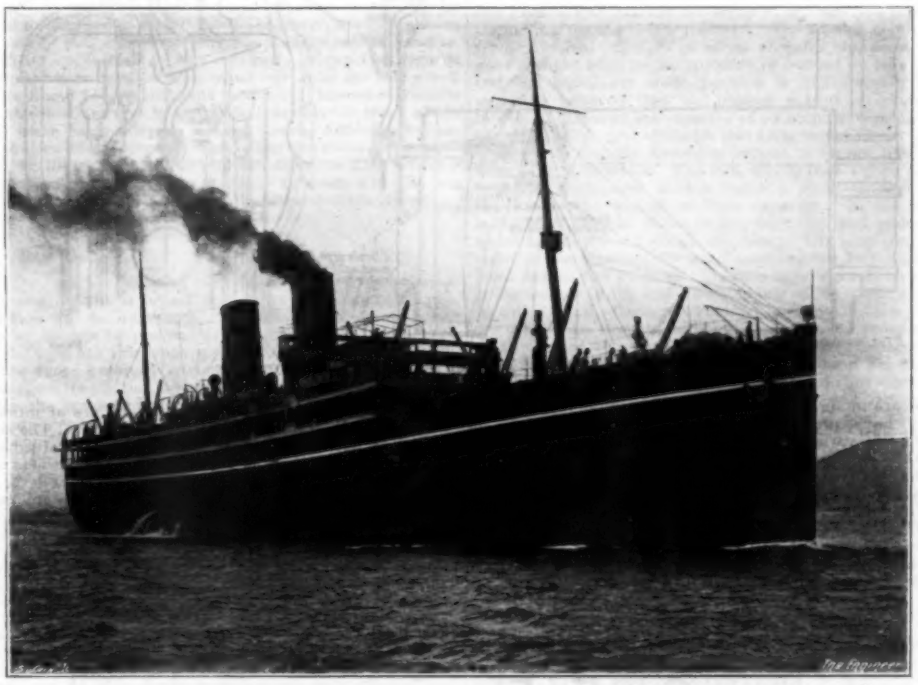
As illustrating the developments which have taken place in the design of heavy lathes within the past few decades, we also illustrate a machine with the same height of centres made by Messrs. Harvey for the same purchasers over thirty years ago. This lathe is still in active service, and we are told that its performance is so satisfactory that the makers were asked to duplicate it. In the end, however, the machine we have just described was supplied, and although it will be noticed that in broad outline the two lathes are somewhat similar, there is a decided tendency towards solidity in the new design, while the convenience of the operator is more carefully studied.

The Peninsular and Oriental Liner Mooltan.

ON Monday afternoon there arrived in the Thames the new P. and O. liner Mooltan, which is the latest addition to the company's fleet and the largest vessel owned by it. The ss. Mooltan left Belfast on Saturday last, with a large company of guests on board, and on the preceding day successful builder's trails were carried out by Harland and Wolff in Belfast Lough. The new vessel is the third ship to bear the name, and before describing her, brief reference to her predecessors may perhaps be made. The first Mooltan, a steamer of 2257 tons Customs' measurement, was built in 1860, and placed in commission the following year. In many ways she was in advance of her times, and compound steam engines were fitted, having a total of 400 horse-power, while other new features were the hydraulic steering gear and the refrigerating machinery. A second ship of the same name was ordered from Caird and Co., Limited, of Greenock, and ran her trials on October 7th, 1905. She was a mail and passenger liner of 10,000 tons register, with engines of 12,000 indicated horse-power and a length of 540ft. She was sunk in war service. The new Mooltan, which we illustrate above, represents a notable advance in size, in cargo capacity and in the standard of comfort and the provision which has been made for the accommodation of passengers. The ship has a cruiser stern, and the general lines of her fore-part are shown in the accompanying view. The hull is divided into twelve water-tight compartments by means of eleven bulkheads, and the double bottom is carried right fore and aft. Ample cargo space is provided in seven cargo holds, which are served by sixteen hydraulic cranes of from 2 to 6 tons capacity. The derrick jibs, it will be noted, are of the lattice type.

Accommodation has been arranged for about 327 first-class passengers and a nearly equal number of second-class passengers, and the main public rooms are lofty and extend practically the whole width of the deck. On the shelter deck there has been placed a large proportion of the first-class cabins, which are of the tandem type. A considerable number of single and two-berth cabins has also been provided. The first-class dining-room is also on this deck. It has windows arranged in pairs, and is panelled and framed in simple Georgian style and finished in ivory colour. On the promenade deck are to be found the first-class smoke-room, with the aft veranda, and on the same deck forward the reading, writing and music room and the first-class lounge and divan. A staircase leads from the promenade deck entrances down to the first-class dining-room.

The second-class dining-room, with accommodation for 272 persons, is furnished with small tables and finished in white with mahogany fittings. On the bridge deck is the second-class smoke-room and music-room, and the second-class cabins are distributed on both the bridge and shelter decks aft. Here, again, the tandem system of cabins has been adopted, giving daylight to each room. All cabins are provided with a separate heater and a fan, and the heating and ventilating equipment throughout the ship is of the most recent design. There is also a very complete telephone and call bell system, both for the working of the ship and for the use of the passengers. The kitchens have been fitted out with electrically driven auxiliary machinery and electrically heated cooking appliances.



THE P. AND O. LINER MOOLTAN

THE MACHINERY INSTALLATION.

The Mooltan is propelled by twin-screw machinery, comprising two sets of inverted quadruple-expansion engines arranged for 100 deg. Fah. superheat, and designed to develop between 15,000 and 15,500 indicated horse-power, at a mean service speed of about 16 knots. The engines are balanced on the Yarrow-Schlick and Tweedy system, and the cylinders have the following diameters, 33in., 47in., 67½in. and 97in., with a piston stroke of 60in. The condensing plant consists of a three-flow type Harland and Wolff condenser, with independent air and cooling water-circulating pumps, the latter being electrically driven.

Steam is generated in six double-ended and two single-ended boilers, designed for a working pressure of 215 lb. per square inch. The double-ended boilers have a mean diameter of 16ft. 6in., and are 20ft. in length, while the two single-ended boilers have each an internal diameter of 16ft. 3in., and a mean length of 11ft. 8in. All the boilers are arranged for 100 deg. Fah. superheat, and are equipped with oil-burning appliances on the Todd system, working under forced draught. There are four forced-draught fans by Howden, each having an impeller diameter of 78in. The refrigerating plant was made by Halls, of Dartford, and comprises two sets of the firm's horizontal duplex type compressors, with the necessary auxiliary machinery. In general, most of the auxiliary machinery in the engine-room is quite independent of the main engines, and for the most part it is electrically driven.

Brief reference may be made to the electric hydraulic steering gear by Brown Brothers, of Edinburgh, the 20in. searchlight with Parsons split mirror for Suez Canal use, the Willett-Bruce whistle control, and Walkers log. The electric current for power and ship's lighting is supplied from a series of six 150-kilowatt 220-volt direct-current generators. These were supplied by the General Electric Company, Limited, and are coupled to vertical enclosed type compound steam engines by Shanks and Co., Limited, of Arbroath. In addition to the main dynamos, there has been provided an emergency generating set, consisting of a 75-kilowatt 220-volt Diesel-driven generator placed well above the water line. The main switchboards and the emergency switchboard are electrically connected. The sister ship of the vessel we have described, the Maloja, is now in course of completion at Belfast, and it is expected that she will also be added to the P. and O. fleet before the end of the year. Other ships have recently been ordered by the company from Harland and Wolff, and with the addition of these new vessels, the Peninsular and Oriental Steamship Company will be placed in an exceptionally strong position as regards Eastern passenger-carrying trade and commerce generally.

AUTOMATIC CONTROL OF LOCOMOTIVE CUT-OFF.

REGULATION of the cut-off automatically in relation to the load, and utilisation of back pressure to actuate the controlling mechanism, is a new departure in the search for economic locomotive working, which, after extended experiment, has been put into practice on a passenger locomotive of the 4–4–2 type and a goods locomotive of the 2–8–2 type on the Cleveland, Cincinnati, Chicago and St. Louis Railroad. To equalise the fluctuations of back pressure, connections are made from the controller to the four exhaust passages of the two cylinders. When the back pressure tends to rise above a predetermined maximum, owing to load or gradient conditions, the mechanism shortens the cut-off, but when the pressure drops below this figure the mechanism lengthens the cut-off. This action is effected by a rod operated by the pressure variations in the pneumatic controller and connected to the floating lever of the steam or pneumatic reversing gear. In starting, the reversing gear and regulator are operated by hand in the usual way, the automatic device going into action when steam pressure in the valve chest exceeds the air pressure in the controller, and thus unlocks the connection. To reduce speed the regulator may be closed sufficiently to reduce the steam pressure below that of the air, and then the automatic device becomes inoperative. On opening the regulator this device again comes into action. Fuel economy, more uniform performance and elimination of the "human factor" due to the efficiency and personal equation of different enginemen are among the advantages claimed for this new system.

THE reconstruction and enlargement of Waterloo Station and its approaches have taken very many years, for work was begun soon after the present century opened. During the whole of the period the resident engineer was Mr. R. D. Hawes, the new works assistant to the chief engineer, London and South-Western Railway. After a service of forty-two years Mr. Hawes retires at the end of this month.

The "Parry" Boiler Tube Cleaning Blower.

THE deleterious effect of layers of soot on boiler tubes and other heating surfaces is well recognised. Even after only an hour or two's steaming the flue gases of all types of boilers rise considerably in temperature, this rise being due to deposits of soot and scoriæ on surfaces that were originally clean. On removing the deposit the flue temperature immediately drops, because more heat has passed through the tubes or surfaces to assist evaporation.

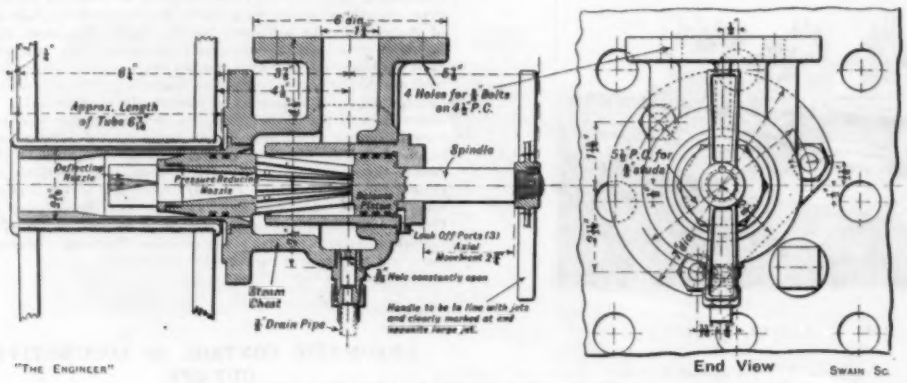


FIG. 1—DETAILS OF PARRY TUBE CLEANER

Manifestly, if the heating surfaces can be swept bare and maintained continuously in a clean condition while the boiler is working, not only will improved evaporation be assured, but the necessity, to say nothing of the expense of tube cleaning by hand, compressed air or other means at the end of a run will also be eliminated.

An example of a device specially intended for this purpose is the Parry steam blower, which is manufactured by C. P. Parry, Limited, at Pownall-square Works in Liverpool. We are informed that many blowers of this type are in successful service in marine boilers, and that they have proved equally satisfactory in water-tube boilers of various types. The most recent development in this country of this type of blower is its application to locomotives, and the accompanying illustrations show it applied to engine No. 205 of the "Claughton" class of the London, Midland and Scottish Railway.

The Parry blower is, in effect, a combination of a De Laval steam nozzle with a deflecting nozzle fitted with accurately machined guide vanes, which is mounted in the boiler in such a manner that it commands all tubes. In operation the potential energy of the high-pressure steam is converted into kinetic energy at atmospheric pressure by a tapered orifice, and the steam is then guided by the vanes in the deflecting nozzle from which it issues at a speed of about 3000ft. per second. In traversing the fire-box towards the tubes the steam jet is said to entrain from seven to ten times its own weight of furnace gases, with the result that the blast through the tubes is hot and dry, although its speed is considerably reduced—to between 300ft. and 400ft. per second in fact. However, as 300ft. per second is over 200 miles per hour, which is more than double that of the fiercest hurricane, the blast is sufficiently strong to carry everything before it through the tubes into the smoke-box, whence, of course, the *débris* must be periodically removed through the door, or ejected through the chimney by a separate blower.

Referring to the drawings in detail, Fig. 1 shows a drawing of the blower, and Fig. 2 its arrangement on the particular locomotive referred to above. It will be noted that the steam nozzles are balanced for steam pressure by a piston so that, during operation, they may be moved easily, both rotationally and axially. The complete operation of the blower is as follows:—The steam is turned on when the blower is in the position shown in Fig. 1 and Fig. 4. Since the deflecting nozzle, when in this position, is retracted into its housing, the steam jets cannot spread but are projected in a straight jet directed towards the central zone marked C in Fig. 3. The blower is left in that position for about 10 to 15 seconds, during which time all tubes in the zone C are, so it is claimed, thoroughly cleaned. The apparatus is then pushed forward until the handle touches the back of the steam chest. The deflecting nozzle has then been brought into the position shown in Fig. 5, with the result that the issuing steam is deflected by the guide vanes in the deflecting nozzle into two separate jets, which are at different angles of inclination to the axis of the blower. The small jet at any particular instant acts upon a group of tubes in the annular zone marked E, while the larger jet acts on a similar group in the zone F on the diagram—Fig. 3. It should be explained that these jets are actually diametrically opposite to one another, although for clearness in the diagram—Fig. 3—they are not shown quite opposite.

With the nozzle in the position just referred to the driver slowly rotates the handle once or twice through complete revolutions, thus causing the jets to command all the tubes in the zones E and F. The guide vane is, the maker states, accurately machined within an error of a quarter of a degree in order that the steam jet may be directed to strike the tubes with mathematical precision. When the blower is not in action the nozzle should be retracted—as in Figs. 1 and 4—to protect the vane against excessive temperatures; but even if this were not done the vanes would probably have a long life, since they are protected by the air which circulates constantly through the tube housing the blower.

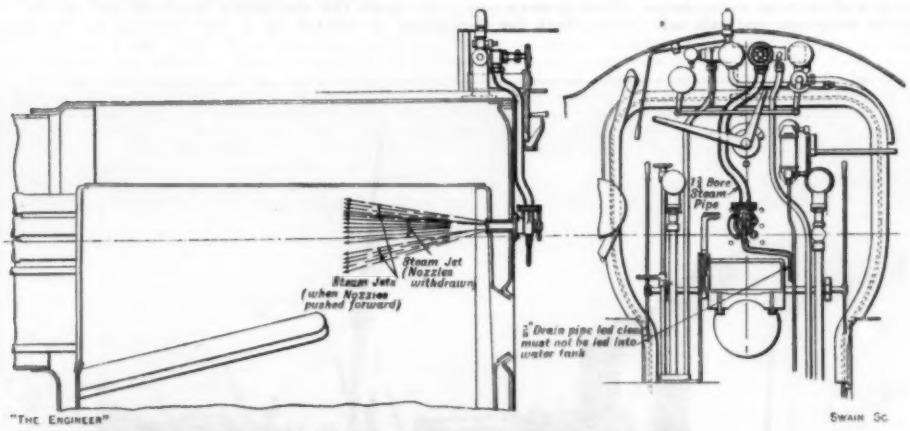

Steam Jet (Nozzles withdrawn)
Steam Jets (when Nozzles pushed forward)
Drain pipe led clear must not be led into water tank
Bore Steam Pipe
"THE ENGINEER"
SWAIN SC.

FIG. 2—CLEANER AS APPLIED ON A L.M.S. LOCOMOTIVE

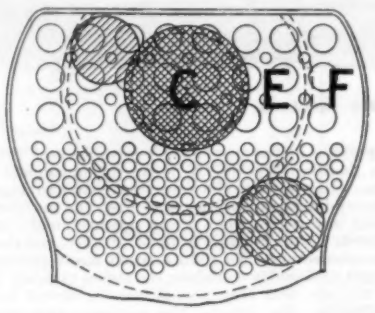
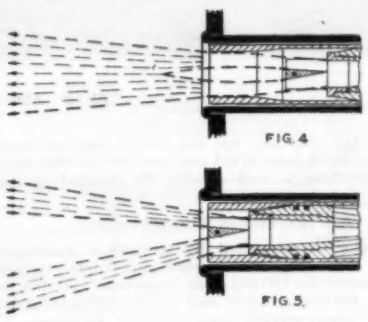


FIG. 3.



FIGS. 3, 4 AND 5—ACTION OF PARRY CLEANER

By the courtesy of Mr. Geo. Hughes, M. Inst. C.E., chief mechanical and electrical engineer of the London, Midland and Scottish Railway, we are enabled to publish the following abstract of a report which he recently made on the operation of this blower:—

ENGINE No. 205, "CLAUGHTON" CLASS.

(Working between Crewe, Carlisle, and London on express work).

"The mileage run up to date is 12,000, during which period no trouble has been experienced nor any maintenance incurred. The blower has been found simple in operation and capable of cleaning a set of tubes in approximately 75 seconds. It therefore does not distract the attention of the enginemen from other duties. Both large and small tubes have been efficiently cleaned and kept free from soot throughout their entire length. Ash can be removed from the top of the brick arch provided the cleaner is operated when the regulator is closed and the steam jet employed so as to ensure no ash dropping into the blast pipe.

Results of Preliminary Trial.

	Total engine miles.	Total train miles.	Coal consumption, lb. per ton-mile.
(*a*)	1978	1956	.160
(*b*)	1533	1512	.176

(*a*) No. 1 period: tubes cleaned entirely by Parry tube cleaner.

(*b*) No. 2 period: tubes cleaned entirely by standard practice.

Coal consumption includes shed duties and lighting up.

"Economy in coal consumption shown by trial derived by the regular cleaning of tubes by the tube cleaner is equivalent to 9.09 per cent.

"This blower was operated every hour on the road."

In the locomotive in question the tubes are 15ft. long and the blower is 8ft. 6in. from the tube plate, making a total distance to be blown through of 23ft. 6in. The tubes, including those containing the superheater tubes, which are, of course, veritable traps for cinders, ashes, and soot, have, so we gather, been maintained perfectly clean for a period of over three months by the use of the blower alone, the brush not having to be used at all during that time. The maker thinks that greater economy even than that experienced by Mr. Hughes may reasonably be expected as a general thing, since, during the above tests, there were very heavy weather conditions against the blower.

Mr. J. Hamilton Gibson, of 3, Central-buildings, Westminster, S.W. 1, is the London representative for C. P. Parry, Limited.

NEW ORLEANS SHIP CANAL.

A NEW canal at New Orleans, connecting the Mississippi River with Lake Pontchartrain, an arm of the Gulf of Mexico, provides a new river harbour and for the service of a number of water-front industries, and is a step towards a new 65-mile route to the Gulf, independent of the 110-mile river route from the city to the mouth of the Mississippi. The canal proper is about 6 miles long, with 32ft. of water, and has a bottom width of 150ft., which will later be increased to 500ft., with lateral branches or slips forming wharves at which vessels can lie to load and unload. In view of the fluctuating level and periodical floods in the river, a lock is placed about half a mile from the river entrance. This lock is a massive concrete structure, with a chamber 650ft. by 75ft., giving 32ft. of water on the sills at low water stages. It has five sets of electrically operated gates. In front of the lock entrance is an emergency gate or dam consisting of a swing bridge, from which—when swung across the lock entrance—panels or shutters can be lowered to rest upon a sill in the bottom. The lock was built in soft wet ground and its structure overall is 1020ft. long, 150ft. wide, and 70ft. high. The canal forms a part of the port facilities, which are owned by the city and managed by a Board of Port Commissioners.

Letters to the Editor.

ELECTRICITY GENERATED BY SAFETY VALVES.

SIR,—Further to Mr. Fleming's letter respecting above, the same phenomena has been observed under varying conditions and in many trades. Without giving a detailed reason for its occurrence, which might be too lengthy for your correspondence column, I would say that the same effect is experienced in the combing of silk, the calendering of paper, the printing of paper, the running of belts, and where steam is emitted at a high velocity—conditions being favourable, as in Mr. Fleming's case—and also where wrought iron steam pipes have split. It is, of course, statical electricity which is produced in all the aforementioned cases, no matter whether electric light or power is used on the premises or not. HENRY S. WHITELEY.

Mill Hill, N.W. 7, September 24th.

IMPROVEMENTS AT THE PORT OF CHERBOURG.

THE ever-increasing Transatlantic traffic of Cherbourg has led to the drawing up of plans for improvements to the harbour, and for a new maritime station. It is estimated that when this year comes to a close, Cherbourg will have served as a port of call for about 800 liners of a tonnage of from 10,000 to 60,000. Every first or second-class passenger landing at Cherbourg pays a toll of 35f., and every third-class passenger 5f., which taxes are considered by the Port Authorities in the nature of interest on the large amount of capital sunk in constructing a breakwater 3 miles long, rendering Cherbourg roads an ideal mooring for Transatlantic liners. While, however, the roads are spacious and have sufficient depth for the largest vessels, the port, on the other hand, where the tenders serving the liners must arrive and leave, is neither spacious nor modern, and the same is true of the maritime station and Customs services. Plans have already been drawn up for the rebuilding of the station, but the Chamber of Commerce considers that this work should be preceded by port improvements. A breakwater of from 1400 m. to 1650 m., running east to west, is to be begun at the Port des Flamands, at the western extremity of the roads. This breakwater, with a similar work built during the war

on the opposite side of the roads, will form an inner barrier leaving a space of 250 m. for the passage of shipping. The commercial docks are to be extended by a mole to the west, which will entail the disappearance of the stretch of beach. The inhabitants of Cherbourg protested against such a step, but the Chamber of Commerce is anxious to proceed with the plan on the ground that it is the beginning of the creation of a deep-water port which would make of Cherbourg a great mercantile clearing house. The first section of improvements to be undertaken will, it is estimated, cost 15 million francs, 3 millions of which will be borne by the State. At least 480,000 tons of stone and concrete will be necessary for its execution, and 584,910 m. of sand will have to be dredged. The first section of the work should be finished within thirty months, and on its completion a maritime station will be built on the mole which will fulfil the needs of the ever-increasing traffic.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Bold Engineering Proposal.

CONSIDERABLE attention has been attracted this week in Birmingham and Midland engineering circles by a suggestion for removing the present trade inertia which has been put forward with a considerable degree of circumstance by Mr. Alex. Ramsay, chairman of the Birmingham and Wolverhampton Association of the Engineering and National Employers' Federations. Mr. Ramsay declares that the country's manufacturers "cannot face the labour prospects of the coming winter and feel relieved from the necessity of formulating definite proposals to meet the situation. In any case, let us know where we stand and whither we are going." He continues: "Some twelve months ago there was considerable optimism in engineering circles, because it was understood that certain of the railway groups were about to embark on schemes of electrification, costing somewhere between £40,000,000 and £50,000,000. These schemes, doubtless, have been held up because of financial considerations. It may be that the railway groups are playing for position, in the belief that the Government will have its hand forced. That is a matter between the Government and the railway companies which should be determined forthwith. There have also been practical proposals considered for the development of docks and the enlargement of waterways, for the extension of municipal undertakings, and the creation of high roads, all of which would ultimately be profit-making ventures, and the only obstacle to the development of which is the necessary capital and the liability of maintenance." Mr. Ramsay enquires: "What has become of the constant flow of orders to which, in pre-war days, our manufacturers were accustomed from the India Office, the Crown Agents for the Colonies, from the Dominions, and other sources within the Empire? It cannot be that there is no real demand for the products. It is simply that because the economic machinery of the world has been out of gear, development has been unnaturally delayed and trade has suffered in consequence. . . . In a great number of directions there is a demand for bridges, railway extension, harbour construction, power station development, irrigation expansion, many of which in the ordinary course of events would already have been put in hand. . . . The projection of certain of these schemes would have almost immediate effect upon industry in this country." Mr. Ramsay proposes a huge development loan of a quarter of a million sterling, to be known as the Empire Development Loan, interest and capital to be guaranteed by the Government and other of the Empire administrations. He expresses the view that such a scheme by responsible authority would receive "overwhelming approval and support." Mr. Ramsay's view is that the situation has become so critical that the State must take greater risks than it has hitherto been prepared to take. He is not the man to start a hare and let it get away from him for want of following up. An amplification of his proposals is being awaited with keen interest.

The Outlook.

The outlook in the iron and steel industry in the Midlands continues, I am happy to state, to show slight improvement, but the depression has been so real and sustained that manufacturers are sceptical and disinclined to build hopes, except on solid business grounds. Many iron and steel masters have succeeded in persuading themselves that matters are mending, and everyone hopes the worst is over. There is no doubt about there being more inquiries and more orders going, and these, even though small, afford some encouragement to those who are endeavouring to propagate optimism; but it has yet to be proved that the movement is broadly based, and that it is not a mere "flash in the pan."

Inadequate Transport Facilities.

There is a prospect that something may be done, as far as the Midlands are concerned, towards eliminating the existing transport difficulties. Birmingham and Midland manufacturers, in common with those in other parts of the country, have for some considerable time expressed much dissatisfaction with the inadequate facilities afforded for the transporting of their manufactures, either for shipment or to other parts of the country, and a meeting of manufacturers in Birmingham has sanctioned the formation of a joint committee of railway officials and manufacturers to attempt to solve the problem. This committee will be supplementary to the Rates Tribunal in London, and will be composed of representatives from 150 traders' associations in Birmingham, South Staffordshire and East Worcestershire. It should be capable of accomplishing much good work, and, given a fair chance, some success should crown its efforts.

Effect of the Boilermakers' Dispute.

The prolongation of the boilermakers' dispute is deepening the depression in important Black Country industries, particularly those which are dependent upon shipbuilding. So far as boilers employed in manufacturing industry and general power raising are concerned, the interruption of output does not appear to be very seriously felt. Judging by the stocks in makers' yards, the supply is equal to the demand, which has been very slack for more than a year. The slightly more hopeful outlook in regard to the boilermakers' strike is considered of great importance, as the view is held that a slight revival has commenced which will make progress, especially if the labour troubles can be settled.

Engineering.

There is a little more activity in some of the engineering branches of Midland industry. Birmingham electrical engineers have orders on their books which ensure regular work at something less than full speed. Experience among mechanical engineers in this area varies widely. A few firms are kept fully occupied, but others are less fortunately placed, and have some difficulty in finding employment for the reduced number of workpeople whom they have been striving to maintain.

Sheet Iron Prices Advanced.

Japan's demands for black and galvanised sheets with which to improvise dwellings and other accommodation till permanent schemes have been evolved and can be given effect to appear to be increasing daily. The sudden strain on supplies has caused prices to stiffen further, and this week most Midland mills have advanced their quotations a further 5s. per ton, making galvanised corrugated sheets of 24 gauge £19 5s. f.o.b. A good deal of the demand is for thin sheets of 30 gauge and 31 gauge, which call for light tonnage. Users of sheets at home have hastened to place their orders, and the result has been not only to make the sheet mills busy, but to bring increased work to the large steel establishments, especially in South Wales, whose staple business is the supply of semi-finished material, such as sheet and tin bars, for the finishing mill. Local mills are being called upon to supplement the Welsh supplies. Some of the mills have sold their output until well on to the end of the year.

Manufactured Iron.

It is difficult to find any improvement in the Staffordshire finished iron trade, though many ironmasters are of opinion that things are mending. Nearly all the mills are being kept from actual idleness by turning on to the re-rolling of steel. Prices, however, are no weaker; in one or two directions they are perhaps rather steadier. Cutting appears to be less recklessly pursued as regards nut and bolt bars. The marked bar mills are fairly well placed, and £14 10s. remains the basis. General conditions in the medium and lower-grade branches continue about the same as last week, makers having difficulty in disposing of their output. Unmarked bars can be bought at £11 10s., although the nominal figure is £12. Makers of nut and bolt bars who continue to quote £10 15s. are further disabled in competition by the reduction of Belgian iron to £8 12s. 6d.

Raw Iron.

All the Midland blast-furnaces are finding better demand, and it is hoped no further curtailment of production will be necessary. The market, however, is not strong enough to prevent price-cutting, and transactions in pig iron are this week reported on terms substantially below those generally recognised. So many factors enter into these disparities, however, that they do not materially alter the course of the market. For Derbyshire No. 3 foundry, orders have not been refused at £4 10s. Northamptonshire can easily be bought at that figure. Derbyshire forge is £4 4s. to £4 5s., and Northamptonshire £4 1s. to £4 2s. 6d. Seeing that furnaces are producing at a rate proportionate to current demand, it may be taken that smelters are succeeding in their object of unburdening themselves of stocks which had accumulated. Stocks in this district are low. In no instance that has come to my knowledge do they represent more than the production of a few weeks. Holdings of consumers have been cut down to the minimum, so as to take the utmost advantage of a falling market, and it would seem certain that any new impetus which the market receives must quickly alter the complexion of things. Some Midland smelters are of the opinion that a change is at hand, and there can be little doubt but that the first upward turn will put them in a strong position. They will be able to exact higher prices; consequently, they are not to-day inclined to accept orders for prolonged delivery.

Steel.

There is little change in the steel position, and continental competition continues, though less keenly in some departments. In finished steel, Belgian joists are well below home quotations, and rather large consignments continue to be utilised in building and general constructional work. There is less business activity in foreign semi-finished material. The lowest quotation for Belgian billets received in Birmingham this week is £7 12s. 6d. delivered, an advance of 2s. 6d. on last week's minimum figure. Native billets can be bought in sufficient quantity at £7 15s., although some large works continue to ask £8 and upwards. These comparative figures give insufficient advantage to foreign steel. Some re-rolling mills still have the advantage of unexpired contracts, enabling them to take deliveries of Belgian billets much below the current quotation. Some consultation has taken place over native finished steel prices, but it is not considered that the time is ripe for an advance. Indeed, most of the business which is now being put through is at accommodation figures, and it is reported that this week sections and similar material have changed hands at £9 5s. and £9 7s. 6d., although the recognised figure is £9 10s. The chief complaint of the steel works is the inability to make full production, which renders profit-making practically impossible.

Steel Wire Prices Reduced.

Most descriptions of finished steel wire have been reduced by 20s. per ton, making the basis for bright round mild steel wire in cwt. and half cwt. coils, No. 8 gauge, £21 per ton. The mills are fairly busy, but the change had been expected for some little time. Business, however, does not appear to have been greatly stimulated.

Unemployment Still Decreasing.

It is gratifying to be able again this week to record that the unemployment returns for the Midlands show a decrease in the number of persons out of work. The latest statistics show a fall of 957, the figures being 169,639, as against 170,596 the previous week. Decreases are recorded in thirteen out of the nineteen towns for which figures are available.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER, Thursday.

Iron, Steel and Metals.

ALTHOUGH there have been rumours of rather better conditions and more selling in some of the centres of the iron and steel trades, one cannot say that these rumours have had any definite effect on the Manchester markets. Here all things remain very much as they were, and one begins to doubt whether any change is near. Sellers seem to be fairly confident that prices are at or near the bottom; but the consumer is still inclined to put off his orders as long as possible in the hope of easier conditions. This, of course, leads to slackness of business, and there are a good many people standing idle in the market-place. There is no indication here yet that people are beginning to regain confidence in the future; and one cannot expect any revival of trade until some degree of confidence is felt.

Metals.

There has not been any very definite change in the market for non-ferrous metals since I last wrote. The demand here has been rather small, but while there is so little new work amongst the engineers of the district, one cannot expect any very active demand for metals. The indifference of consumers of copper does not now appear to be connected with any fear that the markets will fall, or any expectation that they will rise. Copper has been a dull market for some time, but has taken a slight turn for the better recently. The advices coming in from America were of a more cheerful character, and gave a slight fillip to the speculative market on this side; but the legitimate trade position is unchanged. It is generally believed that the present output of copper is largely in excess of the capacity of consumers in the actual state of trade; and although there has been talk for some time of reducing the American output, not much has been done in that direction. The difficulty is that a good many American producers cannot make a profit unless they produce to the utmost of their capacity. In the scrap metal trade dealers' prices remain very low, and, generally speaking, all the old metals are cheap. Of these, old gun-metal is the cheapest, for good qualities can be bought at from £48 to £50 per ton. There is only a small business going on here in tin, and chiefly in lots which might almost be called retail. Consumers evidently think that the prices are quite high enough, and that there is more prospect of a fall than of a rise. It may be so, but one must confess that it is very difficult to form any opinion on such a matter. It seems, however, to be expected that when the statistics for September come out, they will not be so favourable as those of August. There is one point in favour of the market, and that is that buying from South Wales has been better. The market for lead keeps very steady, and the fluctuations may almost be disregarded. The actual demand here is only moderate, but buyers seem to have given up the hope of a collapse in prices. There seems to have been rather a larger demand for spelter in galvanising circles, and this has made the metal rather firm of late, with a tendency to higher prices, but the movement is not yet very serious.

Pig Iron.

There has been some little improvement lately in the reports of the pig iron market received from other districts, and it is said that the demand, both in Scotland and in Cleveland has been slightly better. One cannot say that any evidence of this favourable change can yet be found in the Manchester district. Ironfounders here do not show any greater inclination to buy, and the business done is still for small lots and prompt delivery. It may perhaps be admitted that local prices are no worse than they were. The usual quotation for No. 3 foundry iron in Manchester is based on 92s. 6d. at the Derbyshire furnaces, or on 90s. at the furnaces in Northamptonshire; but it has been possible to buy Derbyshire iron at less than 92s. 6d., although no seller will admit that he has yet taken 90s. Probably the latter figure is as low as foundry iron can go until the price of coke is reduced; and there does not appear to be any probability of a reduction until the supplies of fuel from Germany are renewed. There is a little Lincolnshire foundry iron on offer here occasionally, but it is at prices rather higher than those for Derbyshire iron. The demand for Scotch No. 3 foundry iron here remains small, and the prices range from 112s. 6d. to 115s. per ton, delivered in Manchester and the district. Hematite iron costs about the same money in Manchester.

Finished Material.

The market here for manufactured steel is very much as it was. There are rumours of Japanese inquiries for constructional steel, but these come either from Glasgow or from London, and the Manchester market is unaffected by them. Merchants here quote from £9 5s. to £9 10s. per ton for joists and angles, and from £9 15s. to £10 5s.

for common steel plates. Steel bars vary from £10 to £10 10s.; but bar iron is comparatively dear at £12 for Crown quality. The demand for the latter is poor, but the difference between iron and steel is obviously too great. There is now very little continental steel or iron being offered here, and one doubts whether any business at all is being done in it. Reports from the Continent show some uncertainty as to the prices.

Scrap.

There has been no improvement yet in the position of scrap material. A considerable quantity of cast scrap for foundry use is on the market, and dealers are usually quoting £4 per ton for it; although probably if any consumer wanted to buy he could obtain a concession, even on this low price. For heavy wrought iron scrap the malleable ironworks are paying 75s. to 80s. per ton, but the latter only for good lots. Heavy steel melting scrap is neglected, and about 62s. 6d. on trucks appears to be the full selling value now.

Fifty Years' Service.

In order to celebrate the completion of Mr. George Kiernan's fifty years' service with the firm of Gresham and Craven, Limited, Manchester, the employees of this firm held a smoking concert on Friday last at the Old Wheatsheaf Hotel. Mr. Kiernan began his connection with Messrs. Gresham and Craven as draughtsman when the firm was one of comparatively small dimensions. Since then he has risen by sheer merit and industry to the position of director and general manager. Since the death of Mr. James Gresham, he has been very largely responsible for the conduct of the technical side of the business, and has had much to do with the design of many new inventions. The esteem with which Mr. Kiernan is held by all who know him was shown very markedly by the remarks of Mr. W. A. Faux, the secretary of the company, who presided at the concert.

BARROW-IN-FURNESS, Thursday.

Hematite.

There is nothing fresh to report in connection with the hematite pig iron trade. There have been no developments since last week, and judging by the signs, there is not much likelihood of there being any important changes yet awhile. Trade with Scotland is not brisk, and the same remark applies to South Wales. Business done with the Midlands is fairly good, but there is room for considerable improvement. The demand for special qualities of iron is not very keen at present. Customers' requirements seem to be light, and this fact may be due to some extent to the price, although not altogether, for two important additional factors are the influence of the Ruhr trouble and the continuance of the boilermakers' lock-out. Continental business is not brisk, and the trade with America is limited.

Iron Ore.

The iron ore trade is very slow, and is just a reflection of the condition of the trade in pig iron. None of the mines are at anything like full strength or on full time, and some are wholly idle. The business in foreign ore is small, and likely to be so until there is an improvement in the district generally as far as iron production is concerned.

Steel.

The steel trade is dull and prices are low, so low in some cases that it does not pay to book orders for steel rails. The Barrow rail mills after a pretty long period of activity, comparatively speaking, are stopped, as also is the merchant mill. It is not known how long they will be idle, for it depends on fresh orders being booked. A contract which the Workington mills secured will not be completed at once, but between now and Christmas. The hoop and small section mills are busy.

Shipbuilding.

On Tuesday there was launched from Vickers' Naval Construction Works at Barrow, the steam collier Helmwood, the first of two colliers for Wm. France, Fenwick and Co., Limited, of London. She is for the North Sea coal-carrying trade, and has a deadweight capacity of 3400 tons. She will be fitted with triple-expansion engines. She is the first vessel built at Barrow without a single hand-driven rivet. She has been launched to contract time, despite the boilermakers' lock-out. Sir George Higgins, after the launch, on behalf of the owners, congratulated the builders on having put the vessel into the water and emphasised his appreciation of the strenuous work done by the foremen and apprentices, which had made the launching possible in face of all difficulties. Colliers are also being built at Barrow for South Wales.

SHEFFIELD.

(From our own Correspondent.)

The Heavy Steel Trade.

THE hopes of an improvement in the heavy steel trade, which were stimulated by the placing of several orders for billets last week, have not been realised, and we are back to that paucity of buying which has been reported so often of late. Several of the large firms have experienced a falling off in orders, and although a good proportion of the furnaces is still working, it is quite likely that some of them will have to be stopped very shortly. On the acid steel side, not a quarter of the city's productive capacity is being utilised at present. There is a good demand for steel from the departments which are engaged in the making of railway material, but orders here are not coming in to the desired extent, and latterly they have appeared to decline rather than increase. The returns from the employment exchange show that a growing proportion of short-time workers is being registered, which means that the men are employed intermittently, and that orders are small in weight and irregular in their arrival. Confidence in the revival of industry is still to be met with, but it is not so general as was the case a few weeks ago.

Crucible Steel.

The crucible steel trade makes very slow progress in emerging from its state of depression, but some little improvement is noticeable. In spite of the high tariff, America continues to buy Sheffield tool steel to a moderate extent, and there is also a fair demand for carbon steel for cutlery manufacture over there. The bulk of Sheffield's export trade to the States is represented by steel, as the quantity of cutlery sent over there is very small. The condition of the tool steel branch generally may be said to have become steadier during the last few months. The orders, though small in bulk, are coming in fairly regularly, and the trade has made considerable advance upon its condition of a year ago. One of the handicaps from which the trade has been suffering is that resulting from the presence of large surplus stocks of tools made for the Government during the war. These stocks are not by any means exhausted; in fact, huge quantities are being put on the market at present. At an auction sale held last week, the goods on offer included half a million high-speed and carbon twist drills, 300 sets of stocks and dies, 3000 hammers, 500 anvils, and some thousands of files. Other auctions of the same kind are to be held shortly. It is easy to see that, until these stocks are used up, the demand for new Sheffield goods is bound to be seriously retarded.

Cutlery and Plate.

The cutlery trade is already benefiting from the fact that German competition has practically ceased for the time being. Increased orders for pen and pocket cutlery and scissors are reported. If Germany's inability to supply continues, Sheffield should pick up a good deal of trade from South America, South Africa, Belgium, Scandinavia and Eastern Europe, which have been very poor markets for this city for several years. There is a fair amount of activity in the home demand for spring cutlery, and some firms have booked sufficient business to enable them to carry on at nearly full capacity. There is a large sale of stainless cutlery, and reports from the firms which supply material to the makers state that the trade is expanding. The recently reported improvement in the razor trade is due to large orders from Australia. This trade generally is still in a very poor state. The demand for silver and electro-plated hollow-ware keeps low, but there is a brisk call for spoons, forks and cased goods of all kinds, at moderate prices. Price competition is severe, although there have been substantial reductions since last year. Shopkeepers are laying in stocks for the Christmas trade, but they are doing it with great caution, and are avoiding the risk of overburdening their shelves.

Revival of Lead Industry.

Very satisfactory news comes from various parts of the Derbyshire Peak District as to a revival of the old industry of lead mining, once a very important one, but for the past half-century practically dormant, owing to the effects of Spanish dumping. Old mines are being opened and equipped with new appliances, and new sinkings are taking place in several quarters. The Ladywash Mine, near Eyam, which has two shafts, 800ft. deep, is at work again after being closed fifty years. The buildings have been re-equipped with engines and crushing machinery, steel wire ropes have been put into one of the shafts, and a mining cage has been installed for the purpose of taking the men to and from the workings. The Cromford Moor Mine has been reopened, equipped with new engines and crushing plant. At Elton, near Winster, the once famous mine called the Raithe Vein is being worked again, with compressed air drills. The plant includes new engines, crushers, washing and sorting tables for lead ore, and new tools. New sinkings are in progress at Calver Sough and in Middleton Dale. There is a great demand to-day, not only for lead, but for the various by-products of lead mining. Lead itself is wanted for wireless and electrical plant; spar for steel making; barytes for use in rubber, paper, paint works and cloth mills; and zinc for a great variety of commercial uses. There is good hope that the Derbyshire revival will continue, and that, in addition to providing work for miners, it will be of help to those engineering and tool trades which provide the plant and equipment for the mines.

More Colliery Progress.

News as to the expansion of colliery enterprises in this district continues very plentiful. S. Instone and Co., Limited, report that the work of opening out the roads to the recently located Barnsley seam in the Pocklington district of Askern Colliery, near Doncaster, is proceeding satisfactorily, and coal is already being drawn therefrom. The directors state that they have every reason to take an optimistic view of the future of this colliery. In connection with the Butterley Company's development of the virgin coalfield of the Dukeries, a hard seam, 5ft. 3in. in thickness, has been proved at Ollerton, and one of 6ft. at Boughton. The Sheepbridge Company's sinking to the lower measures at Glapwell, which was mentioned last week, is intended to develop the Waterloo, Deep Hard and Tupton seams, and a battery of coke ovens is also to be erected. The colliery will be an entirely new one, quite distinct from the existing Glapwell pit. Another interesting colliery matter is the appointment of judges to award the prize of £1000 which Mr. Charles Markham, chairman of the Staveley Company, has offered for the best vehicle which fulfils certain specified conditions. Mr. Markham's desire is to encourage the production of a safe and efficient type of electrical storage battery locomotive for use underground in coal mines, with a view to displacing pit ponies in deep and hot mines. The competition will be open to manufacturers of any nationality on October 1st, and will be closed on such date, not less than six months thereafter, as the judges may determine. Working trials in England will subsequently be arranged for any vehicles which are selected for test.

A Club and a Recreation Ground.

The Sheffield Association of Metallurgists and Metallurgical Chemists has taken an interesting step forward in its development by opening a club in West-street. The Association was formed in 1917, and now has 200 members. It has done very useful work in encouraging research into metallurgical problems, and the club will be a valuable adjunct to its operations. A second item of news with regard to the social side is that the Hardy Patent Pick Company, Limited, has acquired an area of land, 5½ acres in extent, which it is laying out as a sports ground for its workpeople. Provision is to be made for cricket, tennis and bowling.

NORTH OF ENGLAND.

(From our own Correspondent.)

Cleveland Iron Trade.

THE eagerly anticipated autumn demand has not yet materialised, and the present position of the trade occasions much disappointment. There is no confidence anywhere, and the situation is such that it is too uncertain to forecast the future. There are a few favoured inquiries for pig iron, and sellers appear to be prepared to offer concessions for this class of business. But buyers are not inclined to commit themselves very far ahead, and most of the business done is still of a hand-to-mouth character. There are now only thirty-nine blast-furnaces operating on the North-East Coast, and of the eleven producing Cleveland pig iron, the output of no more than four is available for the open market after producers' own needs are satisfied. The volume of surplus output is thus very limited, but there are big stocks on hand, and it is the existence of these stocks which continues to depress the market. Probably nothing would be so effective in reviving the iron and steel trade as a settlement of the shipyard dispute. The steel works and foundries in this district rely very largely upon shipyard orders, and no doubt many of these will be released if the present efforts result in a settlement of the dispute. Although the general market quotation for No. 3 G.M.B. Cleveland pig iron is 96s. 6d., it is understood that sales have been effected at 96s., whilst No. 4 foundry is down to 91s. 6d., and No. 4 forge to 89s. The scarcity of No. 1 foundry pig iron, on the other hand, keeps the price up to 102s. 6d., and siliceous iron is still 100s. per ton.

Hematite Pig Iron.

More encouraging accounts are given of the East Coast hematite pig iron trade. The cost of French hematite is advancing, and the improvement in the French exchange also turns the balance a little in British producers' favour. Thus there has been a better export inquiry, and whereas a week ago there were sellers of mixed numbers at 98s. 6d. per ton, 99s. is now the minimum quotation, and some makers ask 100s.

Iron-making Materials.

Business in the foreign ore trade is still very quiet, but the market is quite firm. Indeed, the rise in the French exchange is expected to stiffen the price of Mediterranean ores, which are to be paid for in francs. Freights, too, are also firmer, so that 23s. per ton is a minimum figure for the best Rubio ore, the shipment of which from Bilbao has now been resumed. A fall in the price of coke is recorded. In some quarters this fall is regarded as only temporary, as France is expected to be buying again shortly, but at the moment coke supplies are plentiful, and ironmasters can place orders for good Durham furnace coke at 39s. to 40s. per ton delivered at the works.

Manufactured Iron and Steel.

The position in the manufactured iron and steel trade is very discouraging. Business is very slack and many works are having great difficulty in keeping their plant in operation. Foreign competition is again becoming severe. Continental billets are being offered at 20s. to 30s. per ton less than local prices, and the margin between French and British prices for ship plates is even bigger. Manufacturers in this district, however, have cut their prices to the bone, and if they lose orders they prefer to do so rather than sell at a loss. The consequence is that steel trade orders are few, and all the works are slack, though prices are unchanged.

Coal Miners and Wages.

A serious position has arisen in the Northumberland coalfield as a result of the Northumberland Coalowners' Association refusing to increase adult piece-workers from five-sevenths of all county percentage above 50 per cent. to six-sevenths as requested by the men's representatives. A Council meeting of the Northumberland Miners' Association has been summoned to discuss the question.

The Coal Trade.

The Northern coal trade situation is for the most part entirely unchanged, though in one or two instances there is said to be a slightly steadier tone. But any alteration is very slight, and not very apparent. The collieries affect to view the outlook with confidence and assurance, but there is really very little ground for optimism, except that for the next fortnight most of them are fairly well stemmed. Considerable difficulty is, however, being experienced, owing to congestion at the docks. The congestion at Tyne Dock, which is worse than ever, together with the deadlock at Dunston, causes delay and expense, both to the collieries and shippers. Complaints against the railway authorities are voiced, more particularly because of the delay in opening the West Dunston staiths. Considerable interest is evinced in the possible outcome of the efforts of shippers and others to effect some reduction in the harbour and other port charges. It is strongly held that any concession would benefit the trade of the district and encourage the employment of some of the idle tonnage which has been tied up for some considerable time past. Business in both Northumberland and Durham coals is

very flat, and though many of the collieries in both counties are well placed for steams, it is chiefly to be attributed to the running of old contracts. New orders are scarce, so that for forward positions the situation might be much better than it is. There is said to be a number of preliminary feelers in circulation for the whole of next year's shipment, but so far the collieries have not displayed any disposition to accommodate their prices to buyers' ideas of value, so that nothing is possible as yet. The inquiry from abroad is severely curtailed. Neither from Germany nor from Scandinavia is there any large or urgent inquiry. From France, Belgium or Italy there is hardly any business under discussion. Northumberland steam coals are, on the whole, fairly steady for screened first and second grades, while smalls are firm. Durham gas coals are moderately steady for primes and specials, but secondary sorts are slightly lower. Coking coals are a shade easier and more plentiful. The coke market is weaker for foundry and furnace makes, but is steady for gas cokes, which are in fairly heavy demand.

SCOTLAND.

(From our own Correspondent.)

Unemployment Still Growing.

THE lack of improvement in trade is producing more severe conditions in respect to unemployment, if that be possible. So long as the lock-out of boilermakers continues the position is bound to grow worse at the shipyards and in the allied industries. As old contracts are worked off, practically nothing is left. Shipyard stocks are becoming emptied, and consequently unemployment becomes aggravated. Further, the steel and iron works are likewise affected. Shipyards within the Federation are almost dead idle, but those outside, and one or two in particular, have plenty of work on hand. The latter, however, can only in a small way alleviate the distress in general. As time goes on, it is becoming increasingly difficult to keep establishments open, and unless some agreement is soon arrived at between the Boilermakers' Society and the Federation, many concerns will almost be forced to close down for lack of work. Already there are a number of cases in which only appentices and depleted office staffs are in occupation.

Export Possibilities.

For a few weeks now the possibility, or perhaps it would be more correct to say the probability, of an increased export trade has been more widely discussed. From time to time, renewed inquiries from the Far Eastern and other markets have revived hopes in export circles, only to be turned down by a lack of stability at home, inducing a lack of confidence amongst foreign buyers. Once again, however, a better export movement is reported. Inquiries are more prolific than for some time, and there seems good reason to anticipate that considerable orders will follow, more especially if local difficulties are settled sufficiently to allow of anything approaching normal outputs. The tendency of export quotations is still in a downward direction.

Pig Iron.

Though the actual turnover in pig iron shows little improvement, a slightly better feeling exists in the market. Shipping inquiries are more numerous, and there is a growing disposition on the part of buyers to consider forward business. Immediate purchases are still against actual necessities, and these, especially for home consumption, are extremely meagre. Prices are practically unchanged.

More Inquiry for Steel and Iron.

There has been more general inquiry for steel products during the past week. The placing of certain contracts on the Clyde may be partly responsible, but there is at the same time promise of a better all-round dealing with foreign markets. No material improvement can be expected until the works are normally employed, but the sure presence of business is a cause for gratification. With outputs curtailed, stocks of most products, apart from sheets perhaps, are extremely small, and any substantial bookings must mean renewed activities at the various works. Plates and sectional material are scarce, and there is no alteration in home prices. It is doubtful if an export order would gain much concession at present. Steel sheets continue to book a fair amount of export business in light gauges. The situation at the bar iron works has shown little alteration for many weeks now. Demands from all sources are poor, and this remark applies to the re-rolled steel department also. Home prices are unchanged, but the export figures have a falling tendency. The general demand for scrap material is very weak, and prices meantime are advantageous to buyers.

Coal.

In some respects business in the coal trade has been somewhat disappointing. The preceding week seemed to hold out promise of a revival in demands for round fuel, but such a movement has not yet been realised. Lanarkshire ells have had a steady shipping turnover, but splints and steams have had only occasional spurts. Fifeshire and Lothian steams, with the possible exception of third-class Fife coal, also have received small attention, even for export. On the other hand, the demand for all sizes of washed fuels has been freely maintained, and all districts have received a share. Prices for these qualities are very firm, especially for Fifeshire trebles. Buyers generally, however, show a lack of confidence in respect to forward transactions, and any business passing in any descriptions is for short delivery. Home business is unimportant, and any increase noticeable is at most entirely in household supplies.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Outlook.

THERE is nothing very bright to report about the outlook in the steam coal trade. Inquiry from all quarters at the moment is quite slack, and gives no immediate promise of improvement. The tone of the market all round is on the quiet side, and it is with difficulty that many owners can maintain recent prices. The position is that consumers abroad are holding off, not only in the expectation that values may further decline, but for the purpose of seeing what develops in the international political situation. The view appears to be largely entertained that with a settlement of the Ruhr problem the prospects of trade generally will improve; but it is very questionable whether the steam coal trade of this district will benefit by the settlement of the problem. Rather, the opinion is in coal trade circles that there will be a falling off in the demand from the Continent. It must not be forgotten that during the occupation of the Ruhr by France, quite a considerable quantity of coal has been taken from South Wales by Germany, and it is possible that in the near future these demands from the Germans will be curtailed because of increased production at their own mines. In any event, whatever develops the general outlook does not afford very much encouragement. Buyers abroad are practically in all cases proceeding on the hand-to-mouth principle, and only taking their very minimum requirements, while, as previously mentioned, many local contractors continue to experience great difficulty in placing the coals which they have bought from the collieries, even at prices less than those now ruling. So far as operations over next year are concerned, there appears to be no anxiety, either on the part of the coalowners or buyers seriously to consider business over 1924. In the view of prospective buyers, the ideas of the coalowners respecting prices are much too high; but as yet owners are not disposed to modify them, though the probability is that if definite business over next year were submitted to them at a shade less than the figures which they have indicated, the collieries would be inclined to take it.

Reported Anthracite Colliery Deal.

The report has been current in this district that a further deal in anthracite colliery property in the Gwendraeth Valley has been concluded, but the firm which is credited with having purchased the property has issued a denial, and it may well be that the negotiations have not quite reached the stage of completion. The property, which it is rumoured has changed hands, comprises the Great Mountain Colliery, the New Dynant, the Ammanford and the Pontyberem, all of which are well known in the South Wales anthracite coal area. As a matter of fact, it was only quite recently that Mr. J. Waddell, the managing director of the Great Mountain Colliery, Limited, acquired the sole interests of the Ammanford Colliery Company, embracing the Ammanford and Pontyberem collieries. The Great Mountain Colliery is the largest anthracite colliery in the Gwendraeth Valley, and has an output of about 500 tons per day, providing employment for about 1000 men. The Ammanford, Pontyberem and Dynant collieries employ altogether about 1700 workmen.

New Cement Works.

The announcement is made that a company is in process of being formed to establish a cement works near Portskewett, between Newport and Chepstow. At the moment, the negotiations are said to be in a preliminary stage, but if carried through, the proposal is to erect a works entailing an expenditure of thousands of pounds and employing a large number of workmen.

Docks Control.

The Great Western Railway Company is doing its utmost to bring the docks under its own control in this district to as high a pitch of efficiency as possible, and evidence of this is shown in the steps which have been taken at the Bute Docks at Cardiff to get a better grip on the control of the traffic. Quite recently a new system of telephones has been brought into use at the docks, by which means practically all points of the docks are now in direct touch with each other through the private exchange at the chief docks manager's office. Coal shipping appliances, cranes, quays, warehouses, cattle lairs, pierheads, &c., are now all easily accessible by telephone, thus greatly facilitating the control of traffic. About 200 extensions appear in the private directory issued to the staff. The cost of the installation has been upwards of £12,000.

Swansea's Development Schemes.

At a recent meeting of the Swansea Town Council the borough engineer was asked to report on the desirability of developing some 3000 or 4000 acres of land on the east side of the borough in the vicinity of the King's Dock. It was stated by Mr. David Williams that within the next ten years there would not be a vacant yard of land in the borough. Messrs. Palmer, of Jarrow, who were constructing the new dry dock at the King's Dock, would he said, be importing some 3000 or 4000 workpeople within the next few years for the purpose of carrying on their ship-repairing works, and other firms would also be developing their industries. Mr. Williams added that the Palmer company alone was prepared to put up the first 500 houses in order to accommodate its workpeople, and unless the Swansea Corporation were prepared to develop land for building purposes, an authority close on its borders would be coming along to reap the advantage of the rateable value created by Swansea's enterprise.

Current Business.

The current demand for coals is very quiet, and most of the shipments being effected are on contract account. Fresh business is so slow that it is only in the case of a few of the collieries producing the superior qualities, which are very well placed for the next week or so, that prices remain steady. Bad weather, resulting in the delay of the arrival of tonnage, is causing some dislocation of colliery arrangements and making the market very irregular, especially for spot loading. Here and there collieries are forced to accept prices in order to get the release of wagons that scarcely cover the cost of production, now that the costs in respect of wages are higher than they have been throughout the whole year, and will continue so for the next month. Best Admiralty large are nominally quoted at 28s. to 29s., but buyers for prompt shipment are not likely to experience much difficulty in getting their requirements at the lower figure, particularly if they acquire them through a middleman who holds them on contract. Best coking smalls remain fairly steady, but other qualities are plentiful and easy. Among the inquiries in the market is one of 20,000 tons of Admiralty large for the Portuguese Railways for delivery from October to end of November, and another from the Danish Railways for 100,000 tons for delivery from October up to June of next year. Anthracite coals show very little change, and coke and patent fuel are quiet sections.

Books of Reference.

"The Electrician" Directory and Handbook of the Electrical Engineering and Allied Trades. "The Blue Book." Forty-first edition. London: Benn Bros., Limited, 8, Bouverie-street E.C. 4. Price 25s. net.—The whole of this book has been revised and brought up to date. Included in the current issue are the Post Office regulations governing wireless broadcasting, also the conditions which broadcast receivers must fulfil. A great number of additions has been embodied in the alphabetical and classified trades sections which greatly enhances the value of this volume as a book of reference.

"The Electrician" Annual Tables of Electricity Undertakings, 1923. London: Benn Bros., Limited, 8, Bouverie-street, E.C. 4. Price 10s. net.—Over sixteen hundred electrical undertakings are tabulated, and the information included gives, at a glance, all the leading particulars which may be required by engineers and manufacturers.

The Colliery Year Book and Coal Trades Directory, 1923. London: The Louis Cassier Company, Limited, 34, Bedford-street, Strand, W.C. 2. Price one guinea net.—This directory makes its first appearance with the issue before us. All the colliery companies have been included, together with particulars of the size of the pit and output. The statistical section has been compiled by experts, and gives, it is claimed, the first complete survey of the industry. A directory is included of gas and electrical undertakings, blast-furnaces, and other large consumers of coal. Short biographical sketches are given of the leaders of the industry, together with a personal index. This book will prove very useful as a volume of reference.

CATALOGUES.

THE BOWEN INSTRUMENT COMPANY, Leeds.—Leaflet discussing pyrometers.

D. AND J. TULLIS, Limited, Clydebank, Scotland.—Pamphlet. Laundry machinery.

FREDERICK PRATT, 66, Victoria-street, Westminster, S.W. 1.—Illustrated card of safety fuses.

VISLOK, Limited, St. Bride's House, Salisbury-square, E.C. 4.—Pamphlet. The Vislok triple lock nut.

J. H. WILSON AND CO., Limited, Dock-road, Birkenhead.—Catalogue 53c. All kinds of lifting machinery.

WILLIAMS-COOK, Limited, 152, High-street, Shoreditch, E. 1.—Catalogue. Card index and vertical filing systems.

ROSE, DOWNS AND THOMPSON, Limited, Old Foundry, Hull.—Catalogue, fifteenth edition. Oil mill machinery.

THE HENRY WELLS OIL COMPANY, 11, Haymarket, S.W. 1.—Pamphlet. "Tonikol," the germ process lubricating oil concentrate.

RUSTON AND HORNSBY, Limited, Lincoln.—Catalogue No. 4474, giving illustrations and particulars of the Ruston vertical oil engine.

ROYLES, Limited, Irlam, near Manchester.—Illustrated catalogue of articles intended for use in connection with the economic utilisation of heat.

BRUCE PEEBLES AND CO., Limited, Edinburgh.—Pamphlet No. 228. Alternating-current motors, polyphase induction type, large size.

SCARAB OIL BURNING COMPANY, Limited, Carlton House, 11D, Regent-street, S.W. 1. Pamphlets. A selection of the firm's literature on oil burning.

RONALD TRIST AND CO., Limited, 12, Clipstone-street, Great Portland-street, W. 1. Booklet S 7. The "Raybeam" electric gauge glass illuminator.

THE BRITISH ALUMINIUM COMPANY, Limited, 109, Queen Victoria-street, London, E.C.—Vest pocket booklet entitled "Aluminium Facts and Figures."

IBBETSON AND CO., 57/58, Chancery-lane, London, W.C. 2.—Illustrated leaflets concerned with electric lathe grinding attachments and "Universal" electric drills.

TANGYES, Limited, Birmingham.—Catalogue No. 292, Section ii. The Tangye gas engine, with "variable admission" governing. Catalogue No. 297, Section vii. Tangye factors' catalogue.

STURTEVANT ENGINEERING COMPANY, Limited, 147, Queen Victoria-street, E.C. 4.—Publication No. 1093. Pneumatic collection and conveying. Publication No. 1134. Forge plants and forges.

C. F. ELWELL, Limited, Craven House, Kingsway, W.C. 2.—Publication. The Elwell book of diagrams for wireless installations. Catalogue. The Aristophone catalogue of wireless apparatus and accessories.

THE ENGLISH ELECTRIC COMPANY, Limited, Queen's House, Kingsway, London, W.C. 2.—Publication No. 278, "List of Rotary Converter Installations," with illustrations; and Price List 2111 of "Ironclad" oil-break switch pillars, Classes SXD and SXE.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	26/-
(1) Spanish	23/-
(1) N. African	23/-
N.E. COAST—	
Native	—
Foreign (c.i.f.)	23/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	5 5 0	—
No. 1 Foundry	5 5 0	—
No. 3 Foundry	5 0 0	—
N.E. COAST—		
Hematite Mixed Nos.	4 19 0	4 19 0
No. 1	4 19 6	4 19 6
Cleveland—		
No. 1	5 2 6	5 2 6
Silicious Iron	5 0 0	5 0 0
No. 3 G.M.B.	4 17 9	4 17 0
No. 4 Foundry	4 11 6	4 11 6
No. 4 Forge	4 9 0	4 9 0
Mottled	4 7 6	4 7 6
White	4 7 6	4 7 6
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	13 0 0	—
North Staffs. Forge*	—	—
„ „ Foundry	4 10 0 to 5 0 0	
(3) Northampton—		
Foundry No. 3	4 10 0	—
„ Forge	4 1 0 to 4 2 6	—
(3) Derbyshire—		
No. 3 Foundry	4 11 0 to 4 12 6	
Forge	4 4 0 to 4 5 0	
(3) Lincolnshire—		
Basic	4 13 0	—
No. 3 Foundry	4 14 0	—
No. 4 Forge	4 12 0	—
(4) N.W. COAST—		
N. Lancs and Cum.—		
Hematite Mixed Nos.	5 12 6	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	12 0 0	—
Best „	—	—
N.E. COAST—		
Crown Bars	12 0 0	—
Tees	10 0 0	—
LANCS.—		
Crown Bars	12 0 0	—
Second Quality Bars	11 5 0	—
Hoops	15 0 0	14 15 0
S. YORKS.—		
Crown Bars	12 0 0	—
Best „	13 0 0	—
Hoops	14 10 0	—
MIDLANDS—		
Crown Bars	12 0 0 to 12 10 0	
Marked Bars (Staffs.)	14 10 0	—
Nut and Bolt Bars	10 15 0	—
Gas Tube Strip	12 10 0 to 12 12 6	

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	13 0 0	—
Ship Plates, ¼in. and up	10 0 0	—
Sections	9 15 0	—
Steel Sheets, 3/16in. to ¼in.	12 10 0	—
Sheets (Gal. Cor. 24 B.G.)	—	18 17 6

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	9 15 0	—
Angles	9 5 0	—
Boiler Plates	13 0 0	—
Joists	9 10 0	—
Heavy Rails	9 10 0	—
Fish-plates	12 10 0	—
Channels	9 5 0	—
Hard Billets	10 5 0	—
Soft Billets	9 0 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	9 10 0†	—
Light „	11 0 0†	—
Billets	8 0 0†	—
MANCHESTER—		
Bars (Round)	10 5 0 to 10 10 0	
„ (others)	10 0 0 to 10 2 6	
Hoops (Best)	15 5 0	15 0 0
„ (Soft Steel)	13 15 0	13 10 0
Plates	9 15 0 to 10 0 0	
„ (Lancs. Boiler)	13 10 0	—
SHEFFIELD—		
Siemens Acid Billets	12 10 0	—
Bessemer Billets	13 0 0	—
Hard Basic	10 5 0	—
Intermediate Basic	10 0 0	—
Soft Basic	8 0 0	—
Hoops	12 10 0	—
Soft Wire Rods	12 0 0	—
MIDLANDS—		
Small Rolled Bars	9 10 0 to 9 15 0	
Billets and Sheet-bars	7 15 0 to 8 5 0	
Gas Tube Strip	10 10 0	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	19 0 0 to 19 5 0	
Angles	9 10 0	—
Joists	9 10 0	—
Tees	10 10 0	—
Bridge and Tank Plates	10 0 0 to 10 5 0	

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	23/1½ to 23/3
Block Tin (cash)	203 5 0
„ (three months)	202 17 6
Copper (cash)	63 15 0
„ (three months)	64 2 6
Spanish Lead (cash)	25 16 3
„ (three months)	25 10 0
Spelter (cash)	33 17 6
„ (three months)	31 17 6
MANCHESTER—	
Copper, Best Selected Ingots	67 10 0
„ Electrolytic	69 0 0
„ Strong Sheets	96 0 0
„ Tubes (Basis price)	0 1 1½
Brass Tubes (Basis price)	0 1 0
„ Condenser	0 1 2½
Lead, English	27 0 0
„ Foreign	25 10 0

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/10 per lb.	
Ferro Tungsten	1/5½ per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 0 0	10/6
„ 6 p.c. to 8 p.c. „	£21 0 0	8/-
„ 8 p.c. to 10 p.c. „	£20 0 0	8/-
„ Specially Refined		
„ Max. 2 p.c. carbon	£50 0 0	18/-
„ „ 1 p.c. „	£60 0 0	21/-
„ „ 0.75 p.c. carbon	£70 0 0	22/6
„ carbon free	1/6 per lb.	
Metallic Chromium	4/3 per lb.	
Ferro Manganese (per ton)	£18 for home, £20 for export	
„ Silicon, 45 p.c. to 50 p.c.	£11 10 0 to £11 15 0 scale 5/- per unit	
„ „ 75 p.c.	£20 0 0 scale 6/- per unit	
„ Vanadium	17/- per lb.	
„ Molybdenum	9/6 per lb.	
„ Titanium (carbon free)	1/2 per lb.	
Nickel (per ton)	£130	
Cobalt	11/6 per lb.	
Aluminium (per ton)	£82 to £100	

(British Official.)

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	19/6
„ „ Ell	21/6
„ „ Splint	22/- to 24/-
„ „ Trebles	24/6
„ „ Doubles	24/-
„ „ Singles	22/6
AYRSHIRE—	
(f.o.b. Ports)—Steam	19/6
„ „ Splint	22/-
„ „ Trebles	24/6
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	19/9 to 21/6
Screened Navigation	27/6
Trebles	27/
Doubles	24/-
Singles	22/6
LOTHIANS—	
(f.o.b. Leith)—Best Steam	21/3
Secondary Steam	20/-
Trebles	26/-
Doubles	24/-
Singles	22/9

ENGLAND.

(8) N.W. COAST—	
Steams	31/6
Household	46/8 to 57/6
Coke	46/-
NORTHUMBERLAND—	
Best Steams	24/- to 24/6
Second Steams	22/6 to 23/-
Steam Smalls	14/6 to 16/-
Unscreened	20/6
Household	25/- to 28/-
DURHAM—	
Best Gas	24/- to 25/-
Second	22/6 to 23/6
Household	25/- to 28/-
Foundry Coke	50/- to 52/6

SHEFFIELD	Inland.
Best Hand-picked Branch	29/6 to 31/- —
Barnsley Best Silkstone	26/6 to 28/- —
Derbyshire Best Brights	25/- to 27/- —
„ „ House	22/6 to 23/6 —
„ „ Large Nuts	20/- to 21/6 —
„ „ Small „	15/- to 16/- —
Yorkshire Hards	21/- to 23/- —
Derbyshire „	20/- to 22/- —
Rough Slacks	11/6 to 13/6 —
Nutty „	10/- to 12/- —
Smalls	7/- to 9/- —
Blast-furnace Coke (Inland)	34/- to 35/-
„ „ (Export) f.o.b.	41/6 to 42/6

CARDIFF— (9) SOUTH WALES.

Steam Coals :	
Best Smokeless Large	28/- to 29/-
Second „ „	26/6 to 27/6
Best Dry Large	28/- to 29/-
Ordinary Dry Large	26/6 to 27/6
Best Black Vein Large	27/6 to 28/-
Western Valley „	27/- to 28/-
Best Eastern Valley Large	26/6 to 27/6
Ordinary „ „	25/- to 26/
Best Steam Smalls	19/- to 20/-
Ordinary „	18/- to 19/-
Washed Nuts	27/6 to 32/6
No. 3 Rhondda Large	30/- to 31/-
„ „ Smalls	24/- to 25/-
No. 2 „ Large	23/- to 24/-
„ „ Through	18/6 to 20/6
„ „ Smalls	15/- to 16/-
Coke (export)	40/ to 47/6
Patent Fuel	30/- to 33/-
Pitwood (ex ship)	30/6 to 31/-
SWANSEA—	
Anthracite Coals :	
Best Big Vein Large	50/- to 52/6
Seconds	40/- to 42/6
Red Vein	32/6 to 35/-
Machine-made Cobbles	60/- to 62/6
Nuts	60/- to 62/6
Beans	45/- to 47/6
Peas	27/6 to 30/-
Breaker Duff	12/6 to 13/
Rubbly Culm	15/- to 16/-
Steam Coals :	
Large	25/- to 26/-
Seconds	22/- to 23/-
Smalls	14/- to 16/-
Cargo Through	20/- to 22/6

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow.

(8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b.

* Quotations extremely high and nominal. † Latest quotations available.

French Engineering Notes.

(From our Correspondent in Paris.)

Trade and Employment.

FEW events affecting British commercial interests have attracted so much attention here as the reported efforts of the Bradford Chamber of Commerce and other bodies to secure further protection against the importation of goods from countries like France, in which the depreciated currency gives, to makers, a temporary advantage over British firms. So long as there was no threat of fiscal measures, the difficulties of unemployment in England were regarded by the French as the natural consequence of the British financial policy in bringing up the pound sterling to something like its gold value, and there was no sympathy with a policy that placed the franc in the list of depreciated currencies. The relatively unfavourable position of the franc did not have any ill effect upon the trade position here, since the country was able to produce most of its raw material, and was reducing considerably its purchases of foreign foodstuffs; but when the supply of coal and coke from the Ruhr fell off considerably after the occupation, the deficiency could only be made good by procuring raw material which had to be paid for on a gold basis. The situation, therefore, has become less satisfactory for exporters, although their margin of production costs is still sufficient to allow of their selling certain manufactured goods to England at low prices. The returns for many months past have shown that there is a steadily increasing export of French products to England, and at the same time there has been an augmentation of British imports, although they consist largely of coal and other raw material involving comparatively small labour. So satisfactory is the present situation of French manufacturers, that the fear of additional charges on imports into Britain is causing them to view the outlook from a different standpoint, notably in considering the ways and means of preserving the British trade with the aid of reciprocal treatment, if necessary. It is pointed out that the prosperous situation of French trade, as indicated by the volume of business and the absence of unemployment, is more apparent than real, in the sense that it is due to special causes of a temporary character. There is no doubt that many of the causes are more or less transient, but there is no getting away from the fact that France is now far richer in natural resources than she has ever been before, and when the Ruhr problem is settled on the basis of France being supplied with adequate supplies of coke for smelting the Lorraine iron ores this country will still be in a favourable position for doing foreign trade. Therefore the British market must be kept at all costs, and there is reason for believing that with the settlement of the Ruhr difficulty, a policy will shape itself in the direction of a general industrial reconstruction in Europe.

State Railway Works.

The particularly interesting works being carried out on the State railways to facilitate the handling of the suburban traffic from the St. Lazare Station, are rapidly nearing completion. The demolition of the Batignolles Tunnels—see THE ENGINEER for November 17th, 1922—is proceeding satisfactorily without causing the slightest interruption to traffic. For more than a year past, work has been proceeding on the removal of the huge quantity of masonry, and in a very few months it is expected that the demolition will be completed. One of the tunnels has been removed, and two or three others are so far advanced that only the liners remain in position for the greater part of the length. Meanwhile, a road bridge has been constructed across the site of the tunnels, and work has been started at the Boulevard des Batignolles end, where a large bridge is to be built for the Metropolitan as well as for the complicated system of mains which are carried over the railway at this point. At the same time, the widening of the bridge at Asnières has permitted the suppression of dangerous points, and the railway is being enlarged up to Colombes for electrification, so that the local traffic will not, for the most part, run over the main lines. A new local station has been built at Asnières, with extensive sidings, where also the local lines now dip under the main lines. It is obvious that the new arrangement will permit of a considerable acceleration of suburban traffic, while the main line trains will not be held up so frequently as they are at present when nearing Paris. The suburban traffic is increasing so rapidly that the only way of dealing with it effectually in the future will be by the electrification of the system, of which the Colombes section will be probably the first to be put into operation. Although the Auteuil line was equipped long ago for electrification, the State has done nothing to put on electric coaches, probably in the hope that it may be able to arrange with the Metropolitan Company to incorporate it into its system.

Suction Gas Tractors.

The ploughing tractor trials, which are being held at Essonnes, have been so far interfered with by the bad weather that very little work has been done, but it is hoped that the conditions will improve sufficiently to permit of the machines effecting work of a character that will indicate substantial progress, as compared with what was accomplished last year. So great is the interest taken in the trials by makers that no fewer than forty entries have been received, but the greatest curiosity is centred in the class of vehicles with engines running on suction gas under conditions imposed by the Comité Central de Motoculture. It is now generally admitted that there can be little hope for the future of ploughing tractors unless the fuel cost can be considerably reduced, and apparently there is no prospect of this being done for the moment with the "national fuel" composed of petrol with a 10 per cent. admixture of alcohol. The only solution appears to lie in suction gas. Its cost is so low as to render it far more economical than any other kind of fuel, even after taking into account the lower efficiency when used with high-speed petrol engines. The object of the Comité Central de Motoculture in organising the trials at Essonnes is to induce builders of tractors and lorries to fit types of low-speed engines for working with suction gas.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

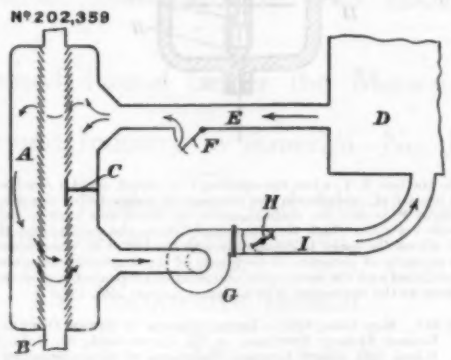
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

202,359. April 19th, 1922.—IMPROVEMENTS RELATING TO FIRING WITH POWDERED FUEL, Wilfred Rothery Wood, of Coventry House, South-place, London, E.C. 2.

The object of this invention is to dry the fuel on its way to the pulveriser by passing over the fuel the waste gases of the furnace, duly diluted with air, and at the same time to avoid discharge of dust at a low level by returning to the flue of the

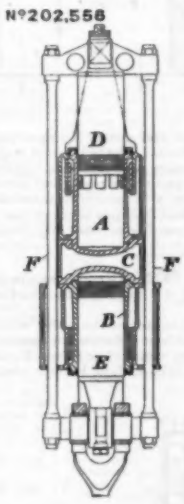


furnace the drying gases after they have left the fuel. A represents a chamber, B a vertical chute extending through the chamber and having walls which are slotted, C a baffle compelling gases that enter the upper part of the chamber to pass twice through the coal before they leave at the lower part, D the flue of a furnace, E a pipe through which flue gases are withdrawn from the flue, F a gate in the wall of pipe E, G a fan, H a gate, I a pipe for return of gases to the flue.—*August 20th*, 1923.

INTERNAL COMBUSTION ENGINES.

202,556. January 30th, 1923.—IMPROVEMENTS IN OR RELATING TO INTERNAL COMBUSTION ENGINES, John McCallum, of 8, Price-street, Birkenhead, Cheshire.

This invention is characterised by the feature that the pair, or each pair, of cylinders is separated by a single diaphragm consisting of a double combustion head which takes the form of a water-jacketed casting and is fitted with Diesel fuel valves for both cylinders. The two-stroke Diesel engine shown comprises

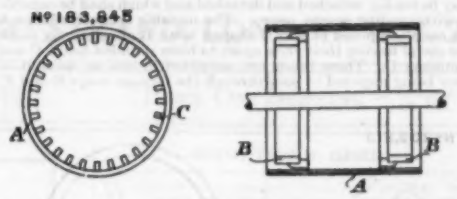


two coaxial cylinders A B which are separated by a single diaphragm C, and within each cylinder a piston D or E reciprocates, the lower piston E being connected directly to a crosshead, which in turn is connected by a connecting-rod to a single crank —not shown—the upper piston D being connected to the crosshead F by rods. The firing stroke of one cylinder coincides with the compression stroke of the other cylinder, and the advantages of a double-acting engine are obtained without the use of packing glands.—*August 23rd*, 1923.

DYNAMOS AND MOTORS.

183,845. July 28th, 1922.—IMPROVEMENTS RELATING TO INDUCTION MOTORS, Hjaimar Charles Ernest Boutard, of 3, Chr. Richardsvej Odense, Denmark.

According to this invention, the current-conducting magnetic element is constituted by a drum or sleeve covering the whole cylindrical surface of the secondary laminated core of the motor and located outside the slots, this drum or sleeve being laminated so as to constitute an active secondary winding in which the so-called "skin effect" of alternating current traversing a conductor is utilised during starting, the ends of the drum or sleeve being extended so as to constitute short-circuiting rings for the currents traversing the drum or sleeve. The magnetic drum or sleeve carries the greater part of the induced current during the starting operation, since the presence of this drum renders the impedance of the non-magnetic secondary winding extremely high so long as the frequency of the induced current is high; that is to say, during the starting operation. For the same reason the induced current flowing in the magnetic drum will, due to the skin effect, be confined to the surface next to the air gap. As the effective ohmic resistance of the drum is relatively high the current consumption during the starting period will be greatly reduced. The left-hand illustration shows a cross-sectional view of the rotor of an induction motor provided with a magnetic drum A in accordance with one form of the invention.

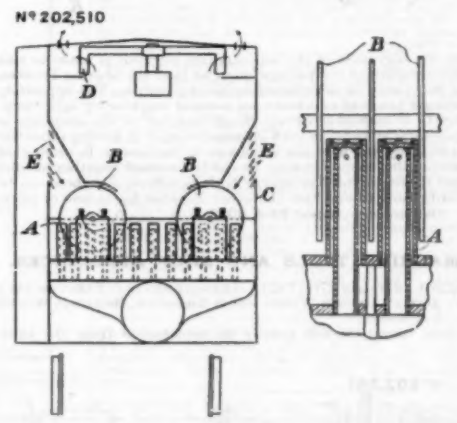


The slots C in the laminated core of the rotor contain the non-magnetic secondary windings. The right-hand illustration shows a view in longitudinal section of the rotor, A being the magnetic drum and B indicating the short-circuiting rings of the secondary winding in the slots.—*August 23rd*, 1923.

CONDENSERS AND FEED-WATER HEATERS.

202,510. August 4th, 1922.—IMPROVEMENTS RELATING TO STEAM CONDENSING PLANT, *Metropolitan-Vickers Electrical Company, Limited, of 4, Central-buildings, Westminster.*

This invention relates to steam condensing plant and has particular reference to surface condensers adapted to be employed with railway locomotives. The heat of condensation is absorbed by the cooling water surrounding the tubes A and is removed by evaporation of a portion of the cooling water in the following manner:—Discs B are arranged to be slowly rotated within the tank C so that the lower halves are immersed within the pool of cooling water. When the discs are rotated films of condensing cooling water from the tank C are conveyed up out of the tank

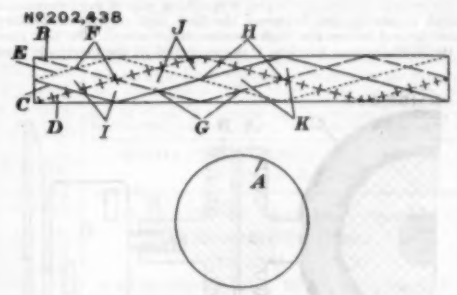


upon the surface of the discs. The fan D draws a constant stream of air through the tank C. The air enters through the openings E at the sides of the tank C and is directed into that portion of the tank in which the rotating discs are fixed. The circulating of currents of air from the inlets E past the discs causes the films of cooling water thereon to be evaporated, the evaporation chilling the disc and any unevaporated water adhering thereto. The chilled portions of the discs upon rotation serve to lower the temperature of the pool of cooling water, with the result that a uniform and satisfactory low temperature of the cooling water is maintained.—*August 23rd*, 1923.

ELECTRICAL APPLIANCES.

202,438. May 27th, 1922.—IMPROVEMENTS IN MULTI-LAYER ELECTRIC INDUCTANCE COILS, Harry Leslie Thomas, of Wykeham, Northenden-road, Sale, near Manchester.

This invention relates to multi-layer electrical coils for use as inductances in wireless telegraphy and telephony and has for its object to provide an improved winding of the coils which gives a high inductance and efficiency with a minimum self-capacity. The wire, which is wound upon a cylindrical former A, is laid in open or coarse spirals so as to build up a pattern. The first complete turn of the former receives the wire in the coil marked B; the second complete coil is marked C, the third coil D, and the fourth E. The pattern is then repeated. The parts where the wires cross one another, as at F G H, build up more rapidly than the remainder, and when a certain number of



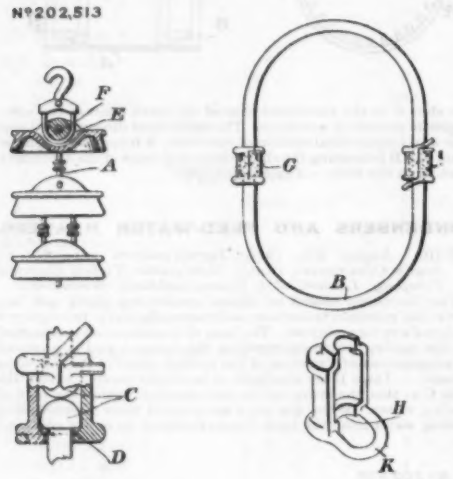
repetitions of the pattern has been wound upon the former, the relationship between the periods of reciprocation of the guide for the wire and of rotation of the former is varied so that the pattern is displaced upon the former and the points where the wires cross, as at F G H, come in the gaps or shallows, as at I J K, between the crossing points of the earlier pattern. After a certain number of repetitions of the displaced pattern the original pattern is restored. The number of times that the pattern is displaced upon the former depends upon the number of layers in the coil. By this means a maximum air space within the coil is provided consistent with efficiency. A high inductance is also obtained as the method of winding gives width to the wire wave without setting up opposing fields in the winding.—*August 23rd*, 1923.

TRANSMISSION OF POWER.

202,513. August 17th, 1922.—IMPROVEMENTS IN AND RELATING TO STRAIN INSULATORS, *The British Thomson-Houston Company, Limited, of Crown House, Aldwych, London, W.C.2.*

The object of this invention is the provision of improved connector loops for connecting strain insulators together, which may be readily attached and detached and which shall be capable of withstanding severe usage. The metallic connector loops A are each composed of two U-shaped bows B of relatively thick bar metal having their ends upset to form rounded heads C and shoulders D. These heads are restricted in size on account of their being required to pass through the passage-ways E and F.

Nº 202,513



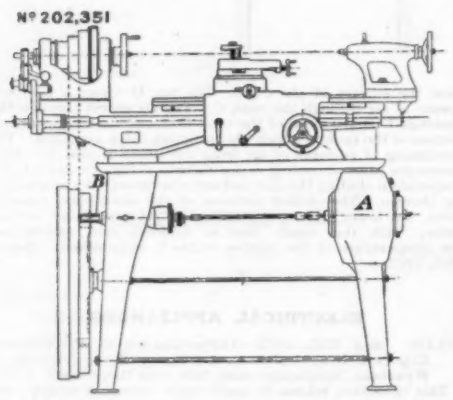
and the curvature of the intermediate portions is made to suit the curvature of the passage-ways so that the bearing between the parts may be distributed as far as possible. The oppositely disposed heads of two bows are secured together by split couplings G of malleable metal. Each member of the couplings is made semi-cylindrical with inturned flanges H having shoulders for co-operating with the shoulders on the bows. In order that the coupling members may be easily fastened together slender clips K are provided on one or both members, and these can be readily bent to embrace the other member by means of pliers or other tools.—*August 23rd*, 1923.

MACHINE TOOLS AND SHOP APPLIANCES.

202,351. January 27th, 1923.—IMPROVEMENTS IN ELECTRICALLY DRIVEN LATHES, Victor Ralph Nicholson, Britannia Works, Colchester.

This invention will readily be understood from the illus-

Nº 202,351



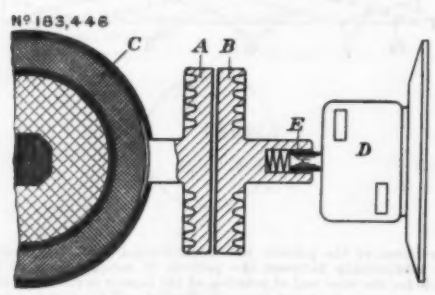
tration. At the poppet end of the lathe the supporting leg is provided with an electric motor A, which drives the lathe through a pinion at B.—*August 28th*, 1923.

MOTOR CARS AND ROAD TRAFFIC.

183,446. July 23rd, 1921.—IMPROVED ARRANGEMENTS FOR INTENSIFYING THE IGNITION SPARK OF MAGNETO IGNITION APPARATUS, Scintilla, of Solothurn, Switzerland.

According to this invention, a sparking gap of predetermined length is interposed between the last turn of the secondary winding and before the high-tension distributor. The last turn of the high-tension winding C is connected to one electrode A of

Nº 183,446



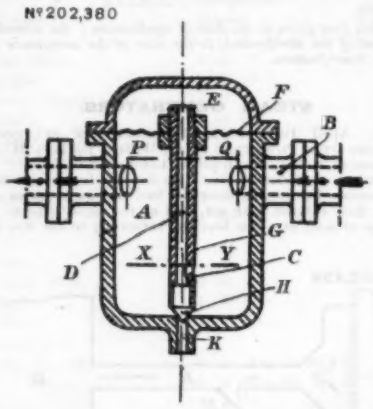
the sparking gap. The other electrode B which receives current from the electrode A transfers this current by means of a carbon brush E to the continually rotating distributor D, from which the current is led to the sparking plugs. The stationary electrodes A and B of the sparking gap are made of good conducting material and are permanently adjusted in position during the manufacture of the ignition apparatus for a strictly determined length of the sparking gap.—*August 28th*, 1923.

MISCELLANEOUS.

202,380. May 15th, 1922.—IMPROVEMENTS IN AUTOMATIC STEAM TRAPS, Joseph Léon Thivolle, of 27, Avenue Malakoff, Paris.

In operation the steam enters the chamber A at B and part of it passes *viâ* the opening C and the tubular part D into the upper compartment E, thus at first equalising the pressure above and below the diaphragm F. The condensed water gradually accumulates in the compartment A until it rises within the tube D

Nº 202,380

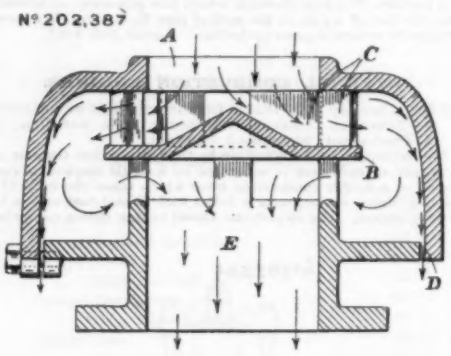


from the line X Y, when the opening C is closed, until it reaches the level P Q, whereupon the pressure of steam below the diaphragm F causes the diaphragm to be lifted and with it the needle valve G, which simultaneously raises the conical end H and allows the water to escape through the outlet K, whereupon the equality of pressure on each side of the diaphragm is again established and the same cycle of operations repeated, and so on so long as the apparatus is in action.—*August 15th*, 1923.

202,387. May 16th, 1922.—IMPROVEMENTS IN STEAM DRYERS, Roland Sydney Portham, of 33, Circus-road, St. John's Wood, and Albert Edward Tompkins, of Little Brookley, Brockenhurst, Hants.

Steam enters the separator through the inlet A and is deflected by the partition B towards the guide deflecting passages through which it flows. The vanes C give a high-velocity rotary flow to the steam. The wall of the separator opposite the vanes C

Nº 202,387

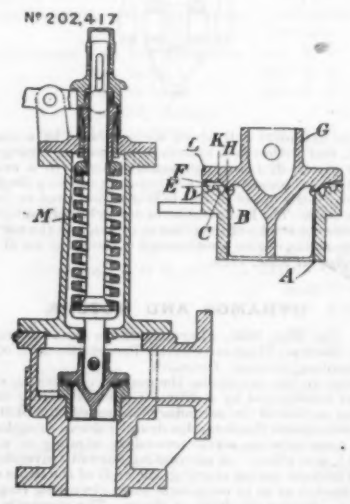


is of curved formation and assists in imparting the high-velocity rotary flow to the steam. The entrained water is separated out by the centrifugal action and proceeds towards a slot along the wall of the separator in a spiral path, and is subsequently ejected through the slot D in a direction tangential to the outer wall thereof. The dry steam escapes through the outlet E. Instead of a single slot D, a number of slots may be employed.—*August 16th*, 1923.

202,417. May 20th, 1922.—IMPROVEMENTS IN SAFETY VALVES, William Grant, of Crag-Ealachaidh, Cardonald, Glasgow, Scotland.

According to this invention the valve seating member A has a flat valve seat B, an inner channel or recess C, an intermediate raised rib D, an outer channel or recess E, and an outer raised rib F. The seat B, ribs D and F, and channels C and E are

Nº 202,417



preferably annular. The valve G is formed with a flat valve face H, an inner lip K overhanging the channel C and rib B, and an outer lip L overhanging the channel E and rib F. When the valve G is raised by the fluid pressure the fluid strikes the side of the channel C and is thus diverted upwards against the lip K. From thence it is diverted downwardly by the concave undersurface of the lip K and impinges on the channel C, where it is diverted against the lip L. The heights of the ribs D and F are preferably arranged as illustrated so that the escaping fluid flows freely over the ribs and consequently does not interfere with the prompt closing of the valve so soon as the fluid pressure falls to such an extent as to allow the spring M to close the valve.—By means of the two sets of recesses and lips the valve receives a double upward thrust. The lift, the inventor points out, is much higher than usual and a smaller valve can be used.—*August 20th*, 1923.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

MONDAY, SEPTEMBER 17TH, TO WEDNESDAY, OCTOBER 3RD.

National Gas Exhibition at Bingley Hall, Birmingham.

SATURDAY, SEPTEMBER 29TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Joint meeting of the North-Eastern and Yorkshire districts at Easington, Co. Durham. 12 noon.

MONDAY, OCTOBER 1ST.

INSTITUTE OF MARINE ENGINEERS.—85–88, The Minories, Tower-hill, E. 1. Extraordinary general meeting *re* alterations to by-laws. 6.30 p.m.

INSTITUTE OF TRANSPORT.—Institution of Electrical Engineers, Savoy-place, Victoria Embankment, W.C. 2. Presidential address by Sir J. G. Broodbank. 5.30 p.m.

SOCIETY OF ENGINEERS.—Geological Society, Burlington House, Piccadilly, W. 1. Paper, "Improved Method for Mass Production of Tank Glass Bottles, Jars, &c.," by Mr. Alec Ferguson. 5.30 p.m.

WEDNESDAY, OCTOBER 3RD.

INSTITUTION OF RAILWAY SIGNAL ENGINEERS.—Institution of Electrical Engineers, Savoy-place, Victoria Embankment, W.C. 2. Paper, "Automatic Telephone Switchboards at Waterloo, Eastleigh and Southampton," by Mr. W. J. Thorrowgood, 6.30 p.m.

INSTITUTION OF SANITARY ENGINEERS.—The Cabin Restaurant, Caxton House, Tothill-street, S.W. 1. Opening sessional meeting. 7.30 p.m.

FRIDAY, OCTOBER 5TH.

DIESEL ENGINE USERS' ASSOCIATION.—Institution of Electrical Engineers, Savoy-place, Victoria Embankment, W.C. 2. Discussion on "Some Notes on a Broken Crank Shaft, &c."

SATURDAY, OCTOBER 6TH.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH.—College of Technology, Sackville-street, Manchester. Presidential address by Mr. R. A. Miles; lecture, "Pig Iron and its By-products," by Mr. J. M. Paul. 4 p.m.

TUESDAY, OCTOBER 9TH.

INSTITUTE OF MARINE ENGINEERS.—85–88, The Minories, Tower-hill, E. 1. "The Pyramids of Egypt," by Mr. W. J. L. Vanstone. Lantern views. 6.30 p.m.

WEDNESDAY, OCTOBER 10TH.

SOCIETE DES INGENIEURS CIVILS DE FRANCE: BRITISH SECTION.—Institution of Electrical Engineers, Savoy-place, Victoria Embankment, W.C. 2. Presidential address by Mr. Roger T. Smith. 6 p.m.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THE INSTITUTE OF COST AND WORKS ACCOUNTANTS has changed its address to 6, Duke-street, St. James', London, S.W. 1. Telephone No., Regent 5407.

KORTING BROTHERS (1917), Limited, have removed from 27, Shaftesbury-avenue, London, W. 1, to 64, Victoria-street, Westminster, S.W. 1. Telephone, Victoria 9829; telegrams, Korting, Vic, London.

MR. GEORGE ARROWSMITH has joined the staff of Hick, Hargreaves and Co., Limited, Bolton, as chief turbine designer and manager of the firm's new steam turbine department. Mr. Arrowsmith was previously chief assistant turbine designer to the English Electric Company, at Rugby.

LAUNCHES AND TRIAL TRIPS.

MELPOMENE; built by Chantiers et Ateliers de la Gironde; to the order of the Compagnie Auxiliaire de Navigation; dimensions, 425ft. by 57ft. by 33ft.; to carry 10,250 tons. Engines, 28in., 46in., and 76in. by 52in. stroke, pressure 180 lb.; constructed by Société Provençale de Constructions Navales; trial trip, September 18th, 19th and 20th.

LESBIAN, single screw steamer; built by Swan, Hunter and Wigham Richardson, Limited; to the order of the Ellerman Lines, Limited; dimensions, 271ft. 4in. by 41ft. 6in. by 32ft. 9in.; 3650 tons deadweight. Engines, three-crank, working at a pressure of 225 lb.; constructed by the Wallsend Slipway and Engineering Company, Limited; trial trip, September 21st.

THE INSTITUTION OF CHEMICAL ENGINEERS.—Owing to a great demand for the paper on "Industrial Oxygen," read by Mr. T. Campbell Finlayson, B.Sc., Associate Member, before the Institution of Chemical Engineers in June last, a limited number of copies has been published and is being issued to the public at 10s. 6d. per copy.